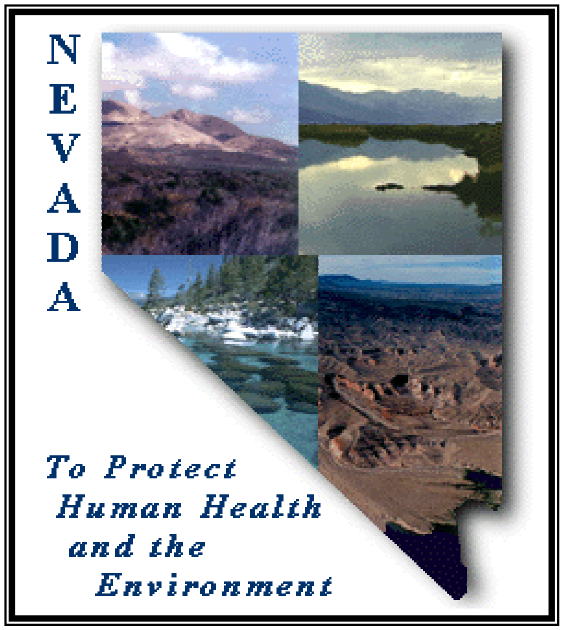

Prevention of Significant Deterioration Increment Tracking System

Technical Support Document

Prepared for

State of Nevada
Division of Environmental Protection

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EXECUTIVE SUMMARY

This report serves as a technical support document detailing the methodology used in the computer-based system developed by the Nevada Department of Conservation and Natural Resources (NDCNR) Division of Environmental Protection (NDEP) Bureau of Air Pollution Control (BAPC), and the Bureau of Air Quality Planning (BAQP), for the tracking of Prevention of Significant Deterioration (PSD) increment impacts. The approach developed by NDEP includes the creation of a PSD increment tracking system (ITS) and the integration of the ITS into the permitting and planning process. This technical support document describes the purpose of the ITS, how baseline and current source information was developed, how the ITS was developed, and how refinements to the emission inventory and the dispersion modeling could be integrated into the ITS in the future.

PSD INCREMENT

PSD increments are a limit on air quality impacts as defined in the federal PSD regulations which are contained within Title 40 of the Code of Federal Regulations, Part 51 Subpart 166 (40 CFR 51.166) and are adopted by reference in the Nevada Administrative Code (NAC) in Chapter 445B Section 221 (NAC 445B.221). PSD regulations are intended to help encourage economic growth while preserving existing clean air resources, and PSD increments are an important part of the program to achieve this objective. PSD increments as defined in 40 CFR 51.166 are limits to increases in ambient pollutant concentration over the baseline concentration. As outlined in the Clean Air Act, and through the authority of the Nevada State Implementation Plan (SIP), the State of Nevada is responsible for assuring that PSD increments are not exceeded.

Allowable PSD increments have been established in 40 CFR 51.166 for three pollutants: sulfur dioxide (SO_2); nitrogen dioxide (NO_2); and particulate matter smaller than 10 microns (PM_{10}). It is important to note that regulations do not allow total ambient air concentrations to exceed the applicable National Ambient Air Quality Standards (NAAQS) limits, even if PSD increment is available (EPA 1990).

PSD increments are tracked on a pollutant-by-pollutant and planning area by planning area basis. The tracking of PSD increments is not applicable until regulatory criteria trigger a minor source baseline date for a specific pollutant in a specific planning area. In Nevada, planning areas have been defined in accordance with section 107(d) of the Clean Air Act, and are represented by hydrographic areas (HAs). PSD increments can be affected by new increment consuming sources, changes to the inventory of baseline sources, and other sources that meet specific regulatory criteria. It is important to note that PSD increment impacts are not simply affected by changes to emission rates, but also by physical changes to source parameters. Throughout this document there are consistent references to source data, not just emission data, since various source parameter changes affect PSD increment impacts.

Changes to PSD increment impacts are the result of net changes in air quality impacts in a triggered HA as compared to baseline conditions. Net changes can effectively result in either a lower air quality impact, referred to as increment expansion, or a higher air quality impact, referred to as increment consumption. The effect of applicable changes on PSD increments is determined by calculating net air quality impacts through the use of air quality dispersion models. Net air quality impacts are determined from what the PSD regulations call a Source Impact Analysis. A Source Impact Analysis is defined in 40 CFR 51.166(k) as follows:

> *Source impact analysis. The owner or operator of the proposed source or modification shall demonstrate that allowable emission increases from the proposed source or modification, in conjunction with all other applicable emissions increases or reductions (including secondary emissions), would not cause or contribute to air pollution in violation of:*
>
> *(1) Any national ambient air quality standard in any air quality control region; or*
>
> *(2) Any applicable maximum allowable increase over the baseline concentration in any area.*

The definition of Source Impact Analysis in 40 CFR 51.166(k) refers to an "applicable maximum allowable increase over the baseline concentration" which is represented by the PSD increments. The PSD increment impact analysis is to be conducted in conjunction with "applicable emissions increases or reductions (including secondary emissions)." Secondary emissions refer to emissions that do not result directly from the process, but can be attributed directly to the operation.

In addition to source related PSD increment impacts from specific facilities, the PSD increment impact throughout a HA associated with changes to existing sources since the applicable baseline date needs to be analyzed by the State. This responsibility is outlined in 40 CFR Part 51, which requires the state of Nevada to develop a State Implementation Plan (SIP). 40 CFR Part 51 states that "Each plan must set forth legally enforceable procedures that enable the State or local agency to determine whether the construction or modification of a facility, building, structure or installation, or combination of these will result in --

- A violation of applicable portions of the control strategy; or
- Interference with attainment or maintenance of a national standard in the State in which the proposed source (or modification) is located or in a neighboring State."

40 CFR 51.166 states that "In accordance with the policy of section 101(b)(1) of the Act and the purposes of section 160 of the Act, each applicable State Implementation Plan … shall contain emission limitations and such other measures as may be necessary to prevent significant deterioration of air quality."

To comply with 40 CFR 51.166, the state of Nevada is obligated to analyze the PSD increment impacts associated with changes to existing sources since the applicable baseline date represented by net changes in impacts between baseline and current conditions. The State of Nevada PSD ITS has been developed to track baseline and current existing source inventories that are used to conduct baseline and current impact assessments. The baseline and current impacts are used in the ITS to calculate net changes in ambient impacts that result from changes at existing sources, between baseline and current conditions, resulting in PSD increment changes.

PSD increment impacts for the pollutant of concern are tracked relative to baseline conditions for minor sources (including area and mobile sources) and major sources. Minor source baseline dates are established following major source permitting actions in each HA, while major source baseline dates were established in 40 CFR 51.166(b)(14)(i) for SO_2, NO_2, and PM_{10} on a nationwide basis.

As stated in the New Source Review Workshop Manual (EPA 1990), once the minor source baseline date for SO_2, NO_2, or PM_{10} is triggered in a planning area, PSD increment is affected by the following changes that occur after the major source baseline date:

- existing major stationary sources having undergone a physical change or change in their method of operation
- new major stationary sources

PSD increment is affected by the following changes that occur after the minor source baseline date:

- Stationary sources having undergone a physical change or change in their method of operation
- existing stationary sources having increased hours of operation or capacity utilization (unless such change was considered representative of baseline operating conditions)
- new stationary sources

In addition to the types of changes to major and minor stationary sources described above, increases and decreases in increment impacts can be associated with a change since the minor source baseline date to area or mobile sources of the triggered pollutant.

INCREMENT TRACKING SYSTEM

NDEP has developed a computer-based system for the tracking of PSD increments in the State of Nevada. This document presents the PSD increment tracking methods developed by NDEP that were incorporated into a PSD ITS. The ITS will allow NDEP to maintain PSD increment source inventories and track PSD increments. NDEP developed the ITS primarily as a tool to evaluate PSD increment impacts, and demonstrate compliance with the requirements of 40 CFR 51, with the benefit of being able to use data from the system for compliance demonstration on permitting and other regulatory issues. It is the intent of NDEP to use the ITS to provide local planners, developers and industry with the information necessary to assure maintenance of PSD increments. The ITS is a database and GIS desktop application developed to achieve the following objectives:

- Provide ready access to major and minor source baseline and current permitted emissions data,
- Generate dispersion modeling input files for PSD impact analyses, and
- Provide tools to enhance the review of PSD impact modeling analyses.

The ITS provides a user-friendly graphical user interface (GUI) that can be used toward the objective of tracking PSD increments by providing the tools to allow the completion of the following tasks:

- Entering source data
- Querying source data
- Generating model input files
- Reviewing modeling results
- Generating emissions and modeling reports

SOURCE INVENTORIES

Source inventories include emission inventories as well as inventories of related source parameters required to conduct Source Impact Analyses used to determine PSD increment impacts. In establishing net impacts from changes in inventories, source information used in determining PSD increment impacts need to be based on the source inventories compiled for the current date and each baseline date for an applicable pollutant. Information in the ITS for stationary point sources are developed from numerous resources including:

- The preceding NDEP permit, source, and emissions database

- State and county air quality agency historical files
- Nevada Minerals Industry Listings
- Permit applications from applicable sources
- State Mines Inspection Reports for the minor and major source baseline dates

Information gathered from these data sources provides a comprehensive history of stationary sources within Nevada for the source inventories. The Aerometric Information Retrieval System Database (AIRData) National Air Pollutant Emission Trends (NET) is also used to identify railroad, vehicle, and miscellaneous area source emissions on a countywide basis for the current year and minor source baseline years.

PSD INCREMENT MODELING

The State of Nevada ITS is used to develop a PSD increment source inventory and to generate dispersion modeling input files for conducting source impact analyses. The ITS is used to prepare air quality dispersion model input files using current and baseline source inventories. The input files are used to conduct modeling analyses to evaluate and document the current status of PSD increment in Nevada's HAs. The actual dispersion modeling is done "outside" of the ITS. Following the PSD increment modeling, the ITS can be used to graphically review and analyze the results.

It is notable that the ITS allows for the calculation of increment consumption by using an "unpaired in time" analysis. This approach is a departure from traditional procedures for increment analysis that calculate changes in impact from current to baseline years using a "paired in time" analysis. When data are available to match the baseline source inventory with concurrent baseline meteorological data, an "unpaired in time" analysis can be more appropriate to represent true changes in impacts between baseline and current years. This "unpaired in time" approach is more fully addressed in Section 5.3.

1.0 INTRODUCTION

This document describes the approach developed by the Nevada Department of Conservation and Natural Resources (NDCNR) Division of Environmental Protection (NDEP) Bureau of Air Pollution Control (BAPC), and the Bureau of Air Quality Planning (BAQP) for the tracking of Prevention of Significant Deterioration (PSD) increment impacts in the State of Nevada. The PSD increment tracking approach presented in this report is the result of efforts undertaken by NDEP with the technical analysis support and project coordination services provided by Tetra Tech EM Inc. (Tetra Tech).

NDEP developed the system outlined in this report, referred to as the PSD Increment Tracking System (ITS), primarily as a tool to evaluate PSD increment impacts, and demonstrate compliance with the requirements of 40 CFR 51, with the benefit of being able to use data from the system for compliance demonstration on permitting and other regulatory issues. In addition, the information obtained from the ITS project can be used to provide local planners, developers, and industry with the tools necessary to identify air quality issues and plan development as necessary to assure maintenance with PSD increments.

This report serves as a technical support document detailing how the ITS was developed by NDEP and integrated into the permitting and planning process of the State of Nevada. This document also suggests future refinements that could be integrated into the ITS.

Backup information concerning the ITS is provided in the report, and applicable regulations and guidelines used in support of the methods developed are identified. The report describes ITS components and how the State of Nevada uses the system in evaluating compliance with PSD increments.

2.0 PSD INCREMENT

PSD increments are the maximum permissible level of increased air quality impacts, due to sources and emissions meeting regulatory criteria, which may occur beyond a regulatory baseline air quality level. The definition of PSD increments in the federal PSD regulations are contained within Title 40 of the Code of Federal Regulations, Part 51 Subpart 166 (40 CFR 51.166). PSD increments are adopted by reference in the Nevada Administrative Code (NAC) in Chapter 445B Section 221 (NAC 445B.221). PSD regulations are intended to allow for economic growth while preserving existing clean air resources, and PSD increments are an important part of the program to achieve this objective. PSD increments are designed to protect against excessive deterioration of air quality. PSD increments are defined in 40 CFR 51.166 as limits to increases in ambient pollutant concentration over the baseline concentration. As outlined in the Clean Air Act, through the authority of the Nevada State Implementation Plan (SIP), the State of Nevada is responsible for maintenance of PSD increments.

Allowable PSD increments have been established for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and particulate matter smaller than 10 microns (PM_{10}) for various averaging periods. Allowable PSD increments do not exist for other pollutants. In addition to assuring the maintenance of PSD increments, the State of Nevada must make sure that National Ambient Air Quality Standards (NAAQS) cannot be exceeded, even if PSD increment is available (EPA 1990).

2.1 NET PSD INCREMENT IMPACT

PSD increments are tracked on a pollutant-by-pollutant basis and planning area by planning area basis. In Nevada, planning areas have been defined in accordance with section 107(d) of the Clean Air Act, and are represented according to the boundaries of hydrographic areas (HAs). The net PSD increment impact represents the net air quality change from the baseline date in a triggered HA. PSD increments are only affected by changes to the inventory of baseline sources, changes to area source emissions, and new sources constructed since the baseline date. It is important to note that PSD increment impacts are not simply affected by changes to emission rates, but also by physical changes to source parameters. Source changes that can affect PSD increments include changing emissions, changing the dispersion characteristics (e.g. stack height, exhaust temperature, orientation of the stack [vertical or horizontal]), or the location of a source. Throughout this document there are consistent references to source data, not just emission data, since various source parameter changes affect PSD increment impacts.

The net change to PSD increments are tracked by calculating net air quality changes through the use of air quality dispersion models which use what the PSD regulations call a Source Impact Analysis. A Source Impact Analysis is defined in 40 CFR 51.166(k) as follows:

> *Source impact analysis. The owner or operator of the proposed source or modification shall demonstrate that allowable emission increases from the proposed source or modification, in conjunction with all other applicable emissions increases or reductions (including secondary emissions), would not cause or contribute to air pollution in violation of:*
>
> *(1) Any national ambient air quality standard in any air quality control region; or*
>
> *(2) Any applicable maximum allowable increase over the baseline concentration in any area.*

The definition of Source Impact Analysis in 40 CFR 51.166(k) refers to an "applicable maximum allowable increase over the baseline concentration" which is represented by the net PSD increment impact. It is important to note that in 40 CFR 51.166(k) the PSD increment impact analysis is to be conducted in conjunction with "applicable emissions increases or reductions (including secondary emissions)."

The Source Impact Analysis refers to PSD increment impacts as net changes in impacts, due to changes in source inventories, between baseline and current conditions. Source inventories therefore need to include not only the change in emissions, but also information pertinent to the dispersion characteristics of the source. This would include the release height, temperature, volume and release velocity, and in cases where GEP stack height or building induced "downwash" is important, the dimensions of building or structures nearby must be included.

In addition to the analysis of impacts resulting from new sources, the affect on the increment associated with changes to existing sources since the applicable baseline date needs to be analyzed. This responsibility is outlined in 40 CFR 51, which requires the State of Nevada to develop a SIP. According to 40 CFR 51, "Each plan must set forth legally enforceable procedures that enable the State or local agency to determine whether the construction or modification of a facility, building, structure or installation, or combination of these will result in --

- A violation of applicable portions of the control strategy; or
- Interference with attainment or maintenance of a national standard in the State in which the proposed source (or modification) is located or in a neighboring State.

40 CFR 51.166 states that "In accordance with the policy of section 101(b)(1) of the Act and the purposes of section 160 of the Act, each applicable State Implementation Plan … shall contain emission limitations and such other measures as may be necessary to prevent significant deterioration of air quality."

Each pollutant of concern, SO_2, NO_2, and PM_{10}, has a major source baseline date and a minor source baseline date that is specific for each pollutant in each HA where the pollutant has been triggered for increment consumption. Major source baseline dates have been established in 40 CFR 51.166(b)(14)(i) for SO2, NO2, and PM10 on a nationwide basis, while minor source baseline dates are established separately for each pollutant according to major source permitting activities in each HA as outlined in 40 CFR 51.166(b)(14)(ii). As addressed in 40 CFR 52 (b)(15)(i), baseline dates are only established for HAs that are in attainment with national ambient air quality standards or unclassified.

Changes to the PSD increment are not tracked, and have no regulatory bearing before the minor source baseline date is established for a particular pollutant. After the minor source baseline date is triggered, the PSD increment, is affected by the change in stationary sources and the change to area or mobile source emissions. The New Source Review Workshop Manual (Draft 1990, Page C-10) (http://www.epa.gov/ttnnsr01/gen/wkshpman.pdf) identifies the sources consuming PSD increment as follows:

> *"Emissions increases that consume a portion of the applicable increment are, in general, all those not accounted for in the baseline concentration and specifically include:*
>
> - *actual emissions increases occurring after the **major source baseline date**, which are associated with physical changes or changes in the method of operation (i.e., construction) at a major stationary source; and*
> - *actual emissions increases at any stationary source, area source, or mobile source occurring after the **minor source baseline date**."*

It is important to note that the type of source changes that result in increment consumption are more inclusive after the minor source baseline date than before. The changes in impacts of triggered pollutants can be associated with construction at major stationary sources after the major source baseline date, or with any changes after the minor source baseline date at major and minor stationary sources and any area or mobile sources of the triggered pollutant.

The New Source Review Workshop Manual defines sources consuming PSD increment to include area and mobile sources. Area sources are defined in the glossary of 40 CFR 51 subpart A, as sources which …"collectively represent individual sources that have not been inventoried as specific point, mobile, or biogenic sources. These individual sources treated collectively as area sources are typically too small, numerous, or difficult to inventory using the methods for the other classes of sources."

PSD increment impact represents a net change in air quality that results from applicable changes to sources of the pollutant of concern. Net changes can result in either a higher air quality impact, referred to as increment consumption, or a lower air quality impact, referred to as increment expansion. The manner in which PSD increment is expanded is described in the New Source Review Workshop Manual (Draft 1990, Page C-10) as follows:

> "*The amount of available increment may be added to, or "expanded," in two ways. The primary way is through the reduction of actual emissions from any source after the minor source baseline date. Any such emissions reduction would increase the amount of available increment to the extent that ambient concentrations would be reduced. Increment expansion may also result from the reduction of actual emissions after the major source baseline date, but before the minor source baseline date, if the reduction results from a physical change or change in the method of operation (i.e., construction) at a major stationary source. Moreover, the reduction will add to the available increment only if the reduction is included in a federally enforceable permit or SIP provision. Thus, for major stationary sources, actual emissions reductions made prior to the minor source baseline date expand the available increment just as increases before the minor source baseline date consume increment.* "

Source data for major sources that existed on the major source baseline date are tracked as baseline impacts. Changes in emissions and source parameters associated with applicable modifications to a major stationary source after the major source baseline date affect the increment. Source changes affecting PSD increments include the changes to the major source prior to the minor source baseline date, although the regulatory implications of PSD increment are not triggered until the minor source baseline date is triggered for that HA. Therefore, when a PSD permit application is filed, setting the minor source baseline date and triggering PSD increment impacts, it is possible to have exceeded the PSD increment by minor changes to major sources even before the proposed changes are permitted, which would likely disallow the proposed modification. According to CFR 51.21(c), major source baseline dates are set nationwide as follows:

- January 6, 1975 – for SO_2 and PM_{10}
- February 9, 1988 – for NO_2

The increment is not affected by changes to minor sources in a HA prior to the minor source baseline date for a particular pollutant, SO_2, NO_2, or PM_{10}, is triggered for that HA. When a new major stationary source submits a PSD permit application or an existing major stationary source applies for a major modification of SO_2, NO_2, or PM_{10} emissions, and the application is deemed complete, the pollutant-specific minor source baseline date is triggered in the HA affected by the major source. HAs that have a triggered minor source baseline date are those where a PSD application was submitted for a new or modified major stationary source, and any nearby HA where the change in PSD increment impacts is 1 microgram per cubic meter ($\mu g/m^3$) or more.

PSD increment impacts are treated as the net change in impact (current impact minus baseline impact) at major sources since the major source baseline date and at minor sources and area and mobile sources since the minor sources baseline date. Current impacts were established through the dispersion modeling of the most recent available source conditions. Baseline impacts are essentially the impacts resulting from source conditions at major sources (that potentially affect the HA) on the major source baseline date, plus the impacts resulting from source conditions at minor sources (including area and mobile sources) on the minor source baseline date. The available increment is affected by applicable modifications to major stationary sources inside or outside the HA after the major source baseline date and by changes to minor sources and area and mobile sources (including fugitives) in the HA after the minor source baseline date. Tracking increments requires maintaining records of the following:

- Major stationary source parameters, including emissions, as of the major source baseline date
- Minor stationary source parameters, including emissions, plus the area and mobile source emissions in a triggered HA following the minor source baseline date.
- Major and minor source parameters, including emissions, plus the area and mobile source emissions for the current situation

By determining major source baseline impacts based on major source baseline date conditions and comparing the impacts to those from current conditions, the impacts from changes to major sources are properly accounted for in the ITS.

3.0 INCREMENT TRACKING SYSTEM

This section presents the PSD increment tracking methods developed by the NDEP and incorporated into the State of Nevada PSD ITS. The ITS allows NDEP to maintain PSD increment source inventories and track PSD increment impacts. It is the intent of NDEP to use the ITS to provide local planners, developers and industry with the information necessary to assure maintenance of PSD increments within allowable limits.

PSD increment evaluations are based on changes in ambient concentrations of airborne contaminants from the appropriate major or minor baseline dates, compared with ambient concentrations from current source conditions. PSD increment is affected by changes to stationary, area, or mobile sources that existed as of the major and minor baseline dates. PSD increment impacts can be affected by changing emissions, changing the dispersion characteristics (e.g. stack height, exhaust temperature, orientation of the stack [vertical or horizontal], or the location of a source.

The ITS is a computer based database and geographic information system (GIS) desktop application that organizes and accesses source data and tracks PSD increment impacts in the State of Nevada. The ITS combines the relational database capabilities of Microsoft Access with the spatial analysis capability of ArcView (a GIS) to provide a desktop application for storing, maintaining, retrieving, and presenting emissions and impact data. The ITS is used to do the following:

- Store, maintain, and provide access to major and minor source baseline and current permitted emissions data
- Generate dispersion modeling input files for conducting PSD impact analyses
- Track PSD increment impacts by maintaining data on baseline, current and net impacts.
- Review results of PSD impact modeling analyses
- Generate emissions and modeling reports

The ITS maintains baseline and current source inventories for the purpose of preparing air quality dispersion model input files to model baseline and current impacts. The actual dispersion modeling is done “outside” of the ITS. Following the modeling analyses, the ITS uses the resulting baseline and current impacts to calculate net changes in ambient impacts that result from changes at sources, between baseline dates and current conditions, thus resulting in PSD increment impacts. The ITS can be used to archive, review, analyze and track the resulting PSD increment impacts.

3.1 SYSTEM DESCRIPTION

The ITS is composed of two major components: a relational database component and a GIS component. Whenever possible, the components share, rather than independently store, data. For example, facility information, such as location and ownership, presented on maps in the ArcView component of the ITS, uses tables and data stored in the Access database. The ArcView component queries an Access table for locations, reads those locations, and presents facilities on the GIS map based on the coordinates and information in the Access table. The ITS is designed so that a user could use only the Access component, only the ArcView component, or both components simultaneously.

3.1.1 Microsoft Access

Access is the relational database component of the ITS. This desktop database application software was selected because of the ability to accommodate several concurrent users, the ability of ArcView to access its data tables, and because it is widely available and has become a 'standard' in desktop relational database management systems (RDBMS). Additionally, Access can be customized to tailor an application to specific user needs, and it can accommodate the type and volume of data used in tracking increment consumption.

The customization of Access for the ITS included the creation of data selection screens tailored to increment consumption and emissions data, data viewers that organize data for review, and report generators. These reports are created in Access report format and American Standard Code for Information Interchange (ASCII) files for use in AERMOD. ITS users that are familiar with Access and relational databases can open data in tabular form to view emissions data and data table relationships, and execute their own data queries.

3.1.2 ArcView

ArcView is the GIS component of the ITS. This desktop GIS software was selected because it is the industry leader in desktop GIS software and provides powerful data visualization, query, and analysis functions. Additionally, ArcView can combine with Microsoft Access to allow users the ability to create and edit geographic data. The customization of ArcView for the ITS included the creation of "buttons" to consolidate frequently occurring command sequences into one "button" or menu selection, and GUIs to guide users to emissions data and HAs and streamline data accessibility. Additional enhancements to ArcView allow it to execute the Access component of the ITS and to use data stored there. The spatial data model used by ArcView is a standard geographic data model and is common to the spatial data used by NDEP.

3.1.3 User Expectations

To operate the ITS effectively, users should have a working knowledge of Access and ArcView. The application contains specific GUIs designed to aid in the retrieval and presentation of data. Inexperienced users of these GUIs will be able to use the application successfully. However, skills in both Access and ArcView will allow users to draw on the additional functionality of both softwares.

3.1.4 Paradox Data

Current data from the state of Nevada was received in a Paradox database. Relevant data was imported into the Access database and brought into the ITS database structure. The original tables imported from Paradox were kept in the database during development for easy checking and to verify all these data were properly imported into the new tracking system structure. Key information from the Paradox database was retained so that linking back to the Paradox database could be performed if necessary. Keeping this key information would also simplify the importing of any data from the original Paradox database that were not needed for the tracking system. For instance, contact information and fee payment information were in the original Paradox database but were not needed for the tracking system. The database was designed in such a way that these data could be easily added to the tracking system later if necessary.

3.1.5 Spatial Data

Spatial data were obtained from BAPC/BAQP and other government agencies, including the U.S. Census Bureau and the U.S. Geological Survey (USGS). The spatial data presented in the ArcView component of the ITS is referenced to the Universal Transverse Mercator (UTM) projection, Zone 11. The project datum is North American Datum of 1983 (NAD83) and the horizontal units are meters. Data were obtained in this projection or converted to UTM Zone 11, NAD83 using established GIS techniques.

Facility locations are created dynamically from data in the Access component of the ITS. ArcView connects to an Access table and uses the UTM coordinate data for each facility to place the facilities on the GIS display.

One-kilometer (km) area source grids were created using GIS techniques. The area source grids are a static dataset established on the 1 km coordinates of UTM zone 11. When the application starts, area source data from the Access component of the ITS is linked to the 1km by 1km spatial data set for presentation. Receptor point locations were also created using GIS techniques at a 500-meter spacing.

Facility location data was derived from the BAPC/BAQP's paradox database and was imported into the Access component of the ITS. The ArcView component of the ITS dynamically references these data and locates the facilities based on their UTM coordinates. As part of the database quality control process, the facilities were plotted on USGS topographic quad sheets and reviewed to ensure that they were properly positioned.

Spatial data obtained from government sources were not checked for accuracy since these data are subject to review by their government source.

Area grids and receptor locations created using GIS techniques were presented on maps and reviewed to confirm their locational accuracy, as well as their impact on model runs.

3.2 DATA RETRIEVAL AND USE

3.2.1 Queries

The ITS application contains queries that create tables used by both the Access and ArcView components of the system. AERMOD input files and user reports can then be created from subsequent queries. For example, **View Major/Minor Summaries for "a Basin"** is a query that can be accessed from the main selection screen of the Access application to create a report for the user. Many queries created for the application are not seen by the user. However, they can be added to the selection screen or accessed through the design view if they appear useful.

3.2.2 Reports

Several types of reports can be created from the data in the Access database. These reports are summarized below.

Facility Information Reports: Facility information reports can be accessed through the main selection screen of the application by selecting the appropriate buttons. For example, to create a report for one facility the user would first select **View System, Control, and Pollutant Details for One Facility** (Figure 3-1), then select a facility from the pick list on the right, and then choose **Open** at the bottom of the form. The report that is returned shows the details of the facility's systems and controls, including emission data for current and baseline dates, and the current stack parameters (Figure 3-2). Company, system, and control information are organized hierarchically in the report. To create a similar report for all of the facilities in the database, select the button **View System, Control, and Pollutant Details for All Facilities** and choose **Open** at the bottom of the form.

Major and Minor Basin Summaries: Summary reports for yearly emission rates can be accessed through the main selection screen by first selecting the button **View Major / Minor Summaries for a Basin** and then selecting a facility, a basin, and whether to show major (greater than 250 tpy) or minor (less than 250 tpy) sources. The user would choose **Open** to view the report (Figure 3-3).

FIGURE 3-1
CREATE FACILITY INFORMATION REPORTS

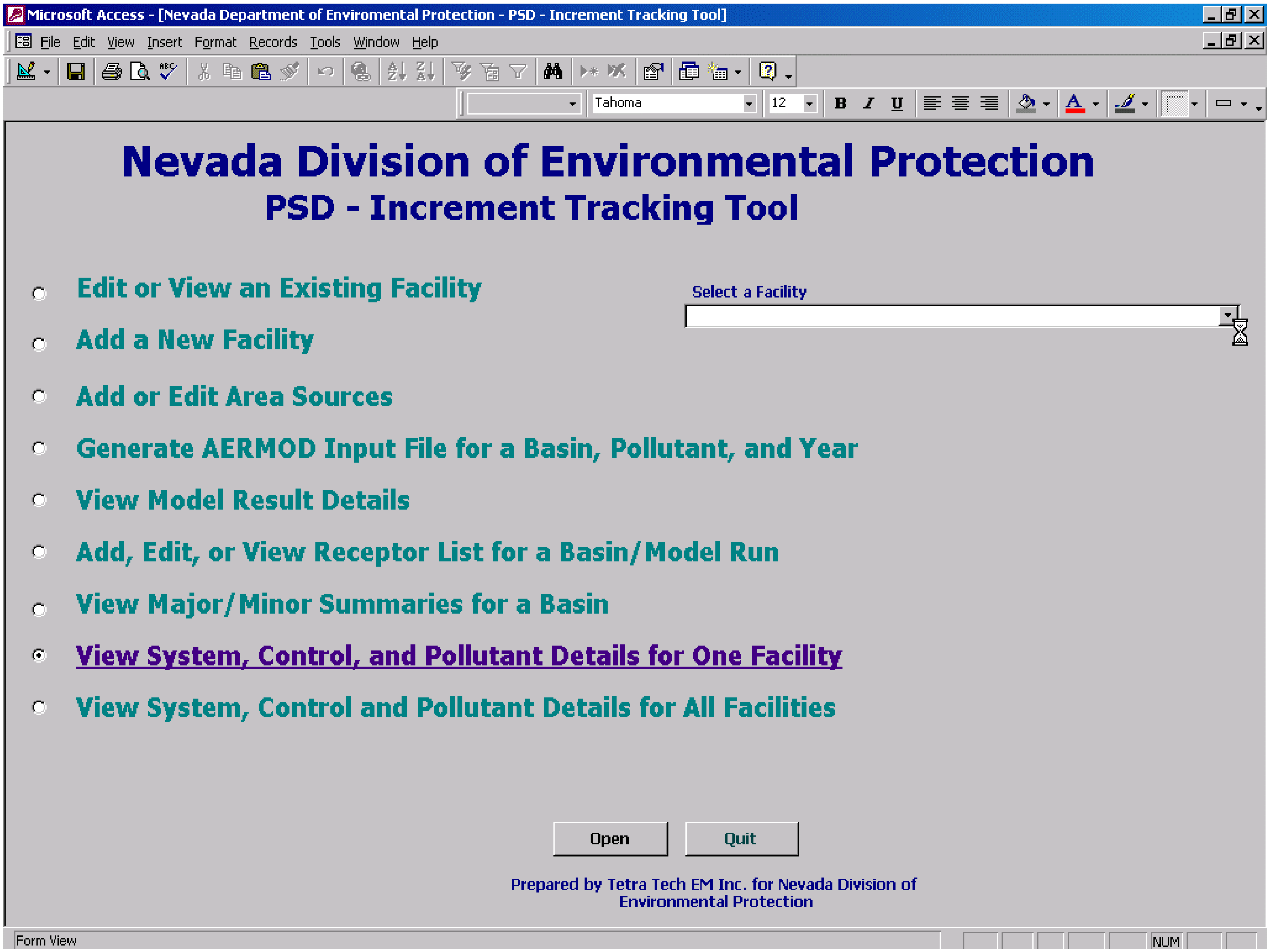

FIGURE 3-2
FACILITY INFORMATION REPORT

NDEP PSD - Increment Tracking Tool - [Summary Report]

File Edit View Tools Window Help

70% Close

Company Name: ALCOA SIERRA MICROMIL

TRACY MICROMILL

FacSeq 0655

Facility ID AP33530655

Basin: 83
76 Within 50
83 In
85 Within 50

UTME-m 282562
UTMN-m 4381335
Elevation-m 1330

Facility Pollutant Totals:	PM10		NOX		SO2			
	1999	1994	1999	1994	1999	1996	1994	1982
	15.59		9.34		0.06			

System	System#	Cntrol Description	Cntrol#	PM10 1999	PM10 1994	NOX 1999	NOX 1994	SO2 1999	SO2 1996	SO2 1994	SO2 1982	Current Stack Parameters: Height (ft)	Diameter (ft)	Temp (F)	Flow (acfm)
MELTING FURNACE	001	GOOD OPERATING PRACTICES	0655-001	8.21		2.76		0.05				79.987	4.0026	1599.8	3021.9
45 MMBTU MELTING FURNACE	002	GOOD OPERATING PRACTICES	0655-001	0.92		6.57						79.987	4.0026	1000.4	3021.9
20 MMBTU HOLDING FURNACE	003	GOOD OPERATING PRACTICES	0655-001									10.367	0	1569.2	0
20 MMBTU HOLDING FURNACE	004	GOOD OPERATING PRACTICES	0655-001									10.367	0	1569.2	0
DROSS ROOM	005	BAGHOUSE	0655-001	2.11								79.987	3.5105	120.2	2038.7
FABRICATION LINE	006	INERTIAL SEPERATOR	0655-001	4.26								120.01	2.6575	130.28	884.41
AGING OVEN	007	GOOD OPERATING PRACTICES	0655-001	0.088		0.01		0.01				79.987	1.3451	500	114.7

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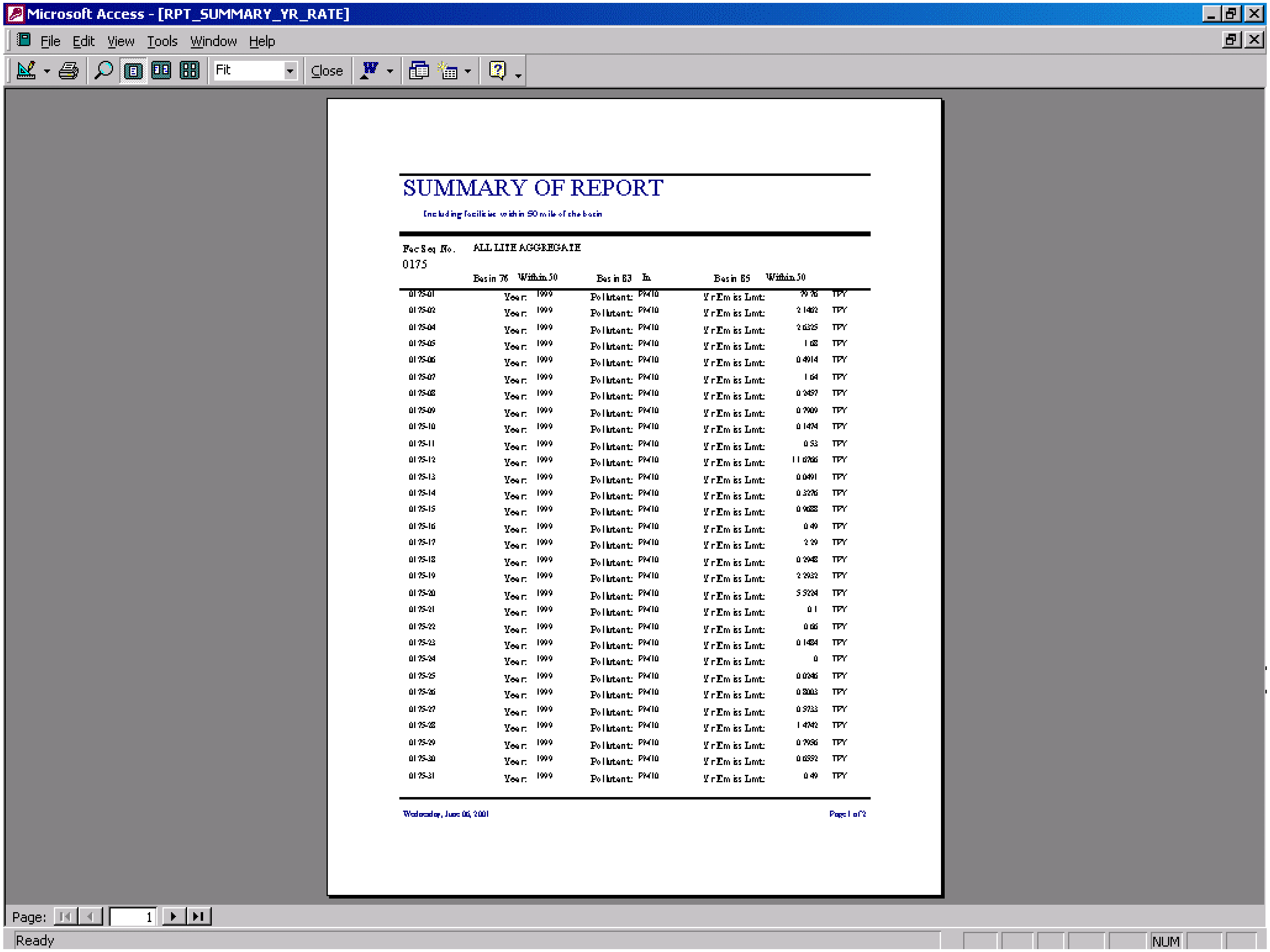
Ready NUM

FIGURE 3-3
SUMMARY REPORT



SUMMARY OF REPORT

Including facilities within 50 mile of the basin

Fac Seq No. ALL LITE AGGREGATE
0175

	Basin 76	Within 50	Basin 83	In	Basin 85	Within 50	
0175-01	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	79.76	TPY
0175-02	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	2.1402	TPY
0175-04	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	2.6325	TPY
0175-05	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	1.08	TPY
0175-06	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.4914	TPY
0175-07	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	1.64	TPY
0175-08	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.2457	TPY
0175-09	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.7909	TPY
0175-10	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.1474	TPY
0175-11	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.53	TPY
0175-12	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	11.0766	TPY
0175-13	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.0491	TPY
0175-14	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.3276	TPY
0175-15	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.9088	TPY
0175-16	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.49	TPY
0175-17	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	2.29	TPY
0175-18	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.2948	TPY
0175-19	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	2.2932	TPY
0175-20	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	5.5284	TPY
0175-21	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.1	TPY
0175-22	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.06	TPY
0175-23	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.1484	TPY
0175-24	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0	TPY
0175-25	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.0046	TPY
0175-26	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.2003	TPY
0175-27	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.5733	TPY
0175-28	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	1.4742	TPY
0175-29	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.7956	TPY
0175-30	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.0552	TPY
0175-31	Year:	1999	Pollutant:	PM10	Yr Emis Lmt:	0.49	TPY

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3.2.3 Tables

The tables that reside in the ITS database were either created by importing data from the BAPC/BAQP's original Paradox database, or were created from researched data. Additionally, some tables were created to provide derived or intermediate information from the original data. The tables in the ITS remain mostly "hidden" from the user by a user-friendly GUI. However, users familiar with Access can easily view data using standard Access navigation techniques.

3.2.4 Creating AERMOD Input Files

A file for source input into AERMOD can be generated from the ITS database application. From the main selection screen, the user chooses **Generate AERMOD Input File for a Basin, Pollutant, and Year (**Figure 3-4). Next, the user chooses a basin, year, and pollutant to model. Pressing the **Open** button opens a new window that has fields containing information to be used as comments in the input file, as well as to name the AERMOD input file. The existing information in these fields can be filled in or changed as preferred. Pressing the **Step One** button at the bottom of the screen continues creating the input file. A selection screen will open showing the facilities within 50-km of the basin that are greater than 100 tons per year (tpy) but less than 250 tpy. Facilities to be included in the model input file are selected from this list. The ITS will automatically include all major and minor sources within the selected basin and any major sources (greater than 250 tpy) within 50-km of the basin. The **Detail** button on this screen allows the user to view the detail page showing system, control and pollutant information for the selected facility. **Close** is chosen when the user is ready to return to the model details page. The model input file would be generated by selecting **Continue** and **Step Two**. At this point the model input file can be viewed in Notepad by choosing **View** from the bottom of the form.

3.2.5 Modifying Receptor Sets

The user can modify receptor sets by selecting the button **Add, Edit, or View Receptor List for a Basin /Model Run** and choosing a basin to edit. A table with a listing of all receptors in the chosen basin will open (Figure 3-5). The data for the default receptor list that will be automatically selected when a specific basin is modeled. The user can add, edit, or remove receptors used for the modeling. The receptors used for a particular model run are retained in the database. This allows for a model input file to be generated at any time as well being able to view any model's results graphically in ArcView or in a table format in the Access application.

FIGURE 3-4
CREATE AERMOD INPUT FILES

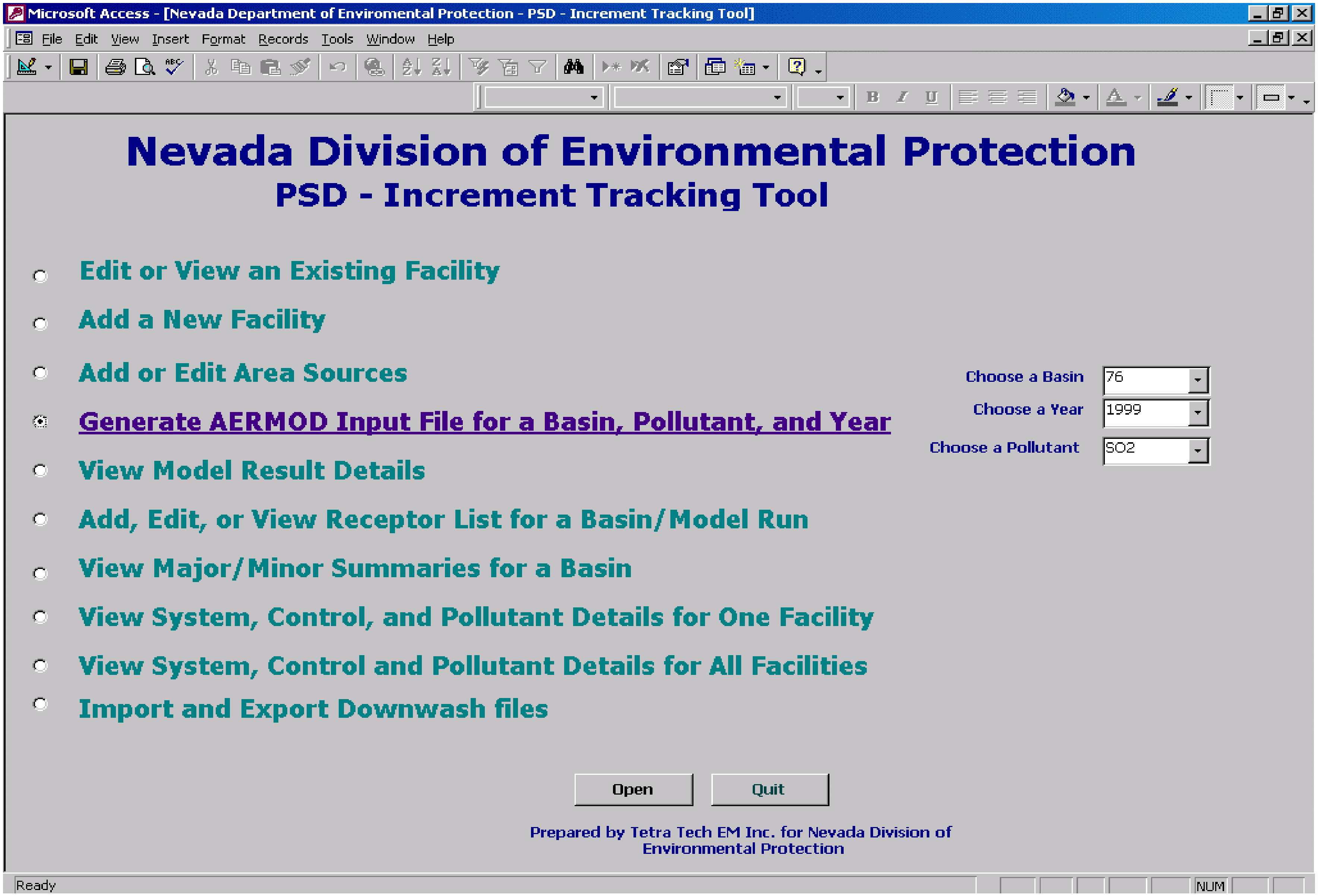
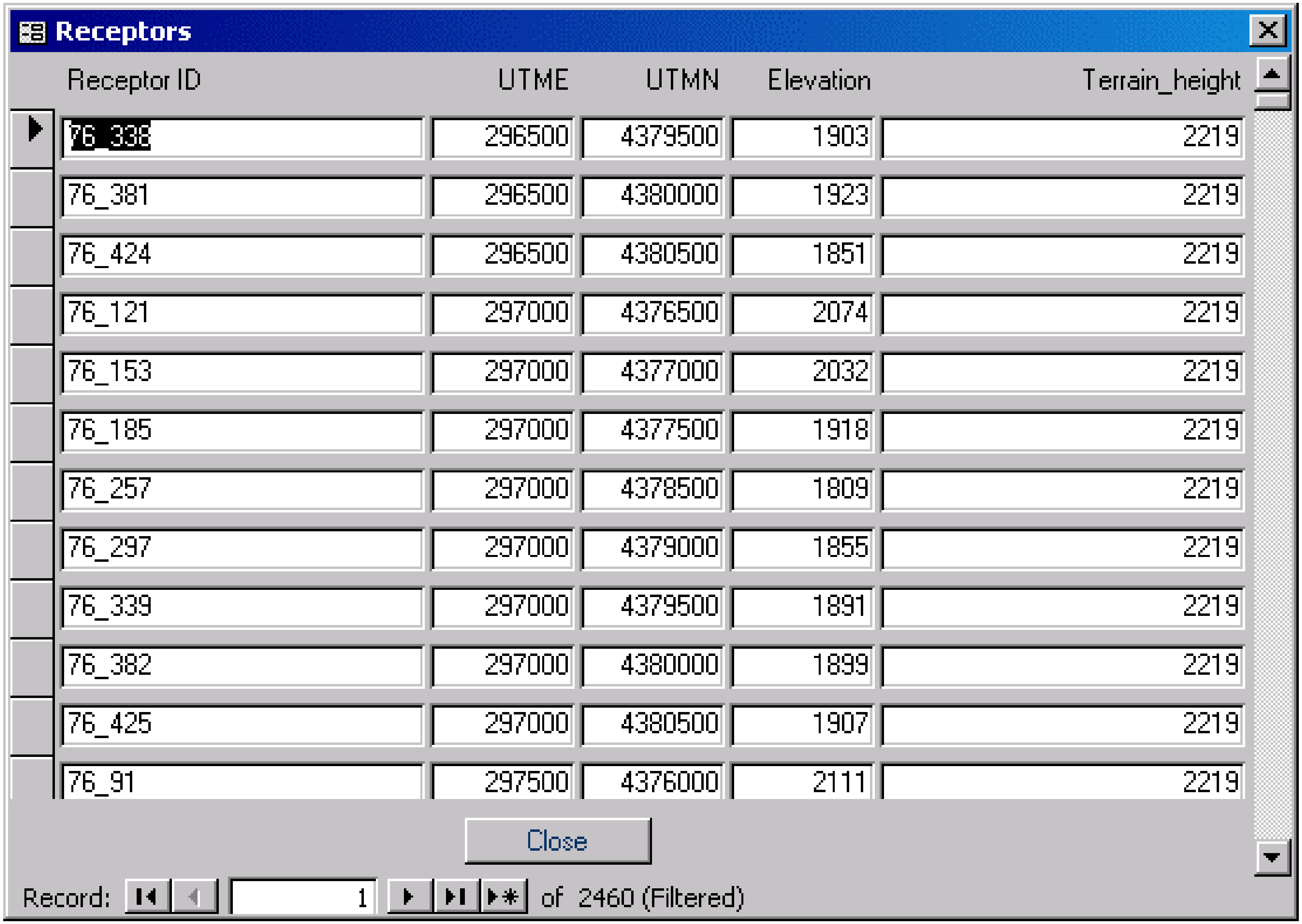


FIGURE 3-5
MODIFY RECEPTOR SETS



Receptor ID	UTME	UTMN	Elevation	Terrain_height
76_338	296500	4379500	1903	2219
76_381	296500	4380000	1923	2219
76_424	296500	4380500	1851	2219
76_121	297000	4376500	2074	2219
76_153	297000	4377000	2032	2219
76_185	297000	4377500	1918	2219
76_257	297000	4378500	1809	2219
76_297	297000	4379000	1855	2219
76_339	297000	4379500	1891	2219
76_382	297000	4380000	1899	2219
76_425	297000	4380500	1907	2219
76_91	297500	4376000	2111	2219

3.2.6 Importing Model Results

Model-run results can be imported by selecting the button **View Model Result Details/Import Results** and choosing the **Open** button. The user must fill in a correct file path and name in the field "File Path and File Name". Then the user selects a correct model result file. If the model results are not in the database, users can select the button **Edit Model** to add a new model result file and its receptors. The user selects a term, such as 3-Hour, 24-Hour, or annual for the model results they need to import. Then, the user can choose the button **Step One** and review the model results in a text editor. If the text file appears correct, users can choose the button **Step Two** to import the results into the database.

3.2.7 Adding and Editing Facility Data

To add a facility to the Access component of the ITS, the user selects the button option **Add a New Facility**. A data entry form opens where facility information can be added (Figure 3-6). Facilities, systems and controls can be added using this option. If a facility already exists in the system, the user can edit the data by selecting **Edit or View an Existing Facility** on the main selection screen. The facility to edit is chosen from the pick list on the right. An edit form opens where the user can edit the facility, system, control and/or pollutant data (Figure 3-7).

3.3 GEOGRAPHIC INFORMATION SYSTEM

3.3.1 Spatial Database Design

The ArcView component of the ITS is organized into maps or views for each of the HAs. Each of the views can be accessed from the ArcView component of the ITS by selecting the desired basin on a reference map. An example basin selection screen is presented in Figure 3-8. A custom button has been added to ArcView to allow the user to easily switch between basins. Alternatively, the user may select basins by using standard ArcView window navigation techniques.

Each hydrographic basin view includes the base map spatial data sets or “themes” for the area, the area 1-km grid cells and receptor points, and the facilities. These themes may be turned on or off using standard ArcView functions. The themes and attribute data for the areas sources are refreshed each time the ITS is started, after the user returns from opening or making changes in Access, and manually by the user by pushing the **Refresh Access Data** button.

FIGURE 3-6
ADD A NEW FACILITY

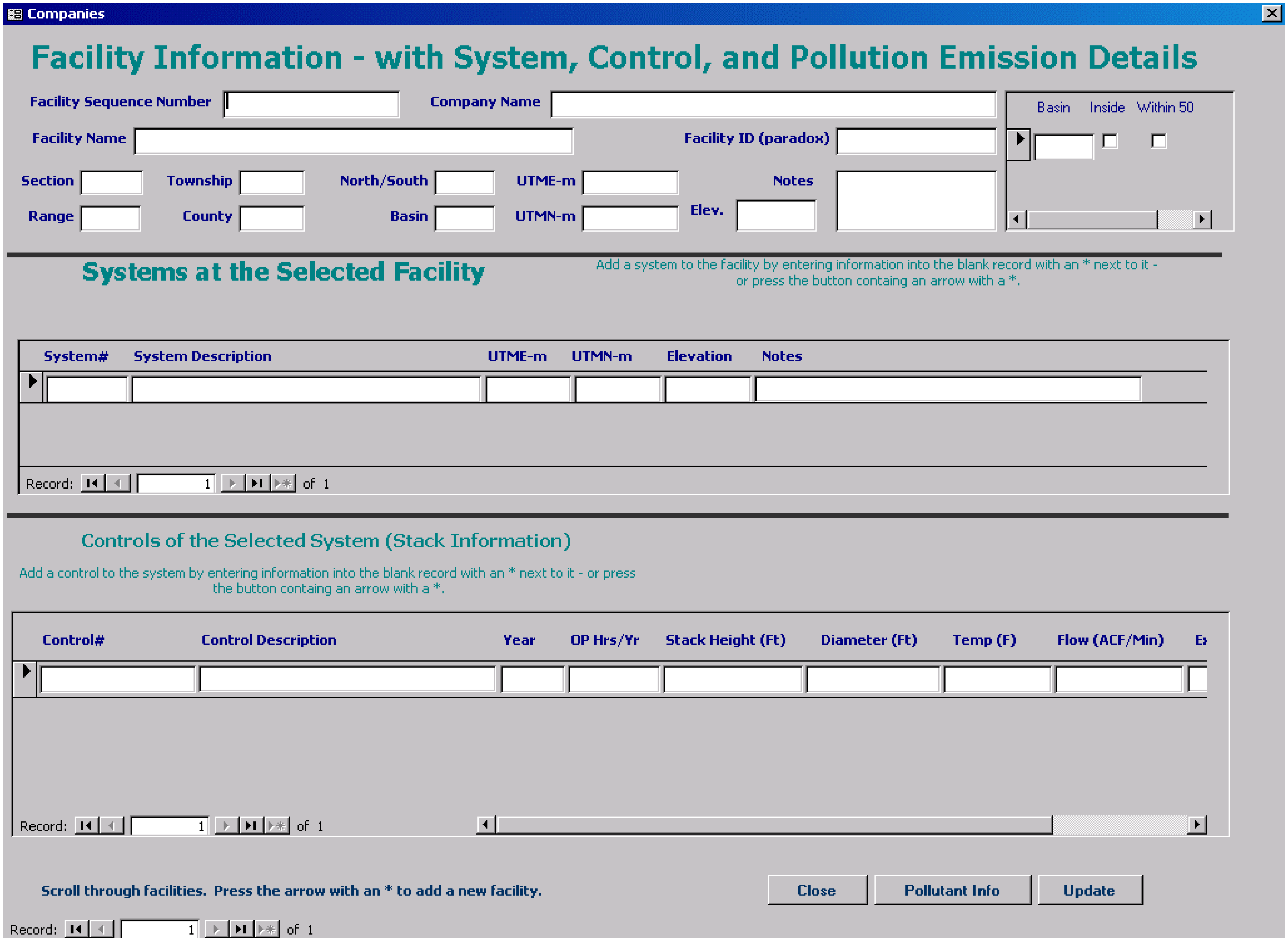
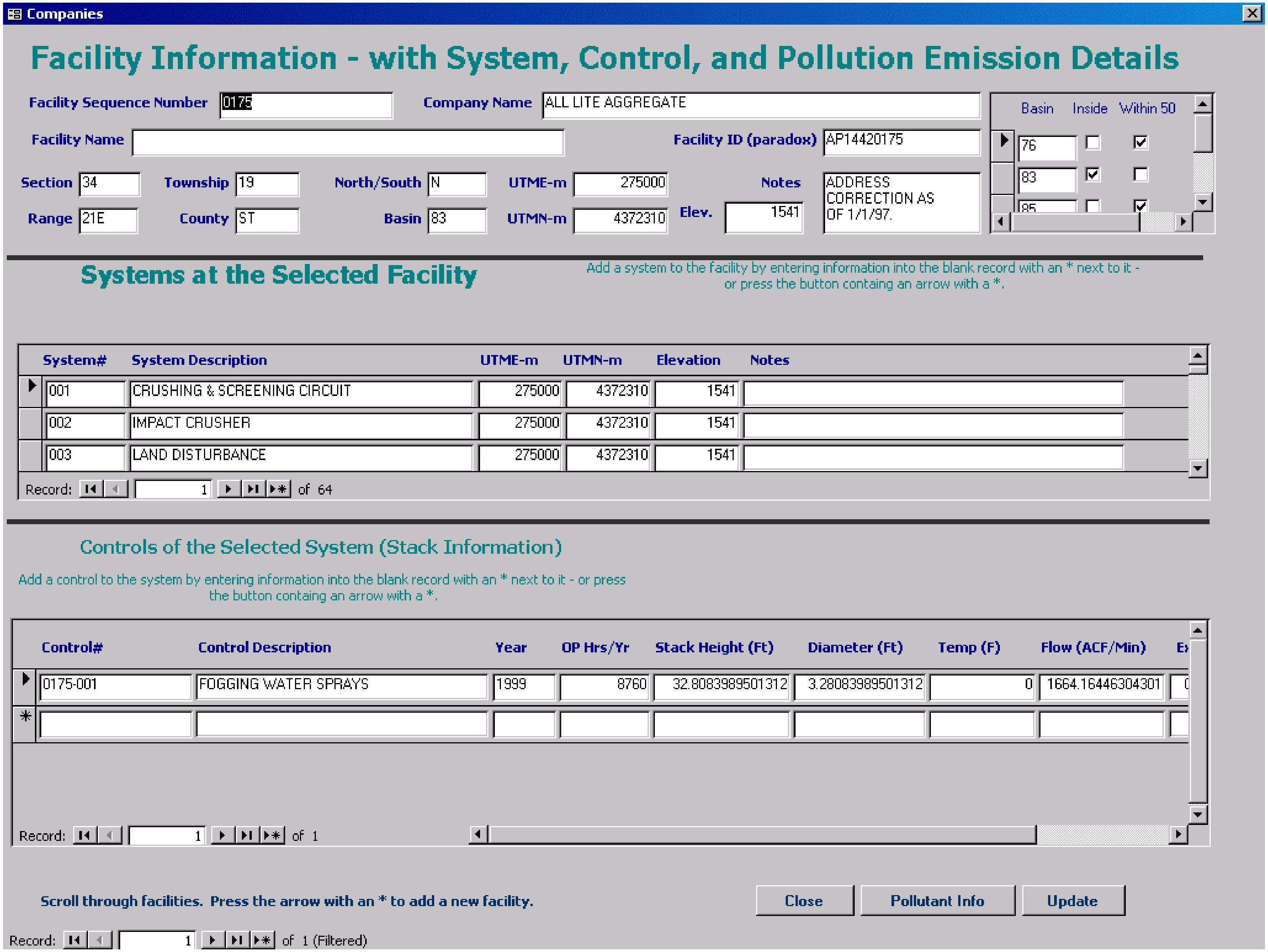
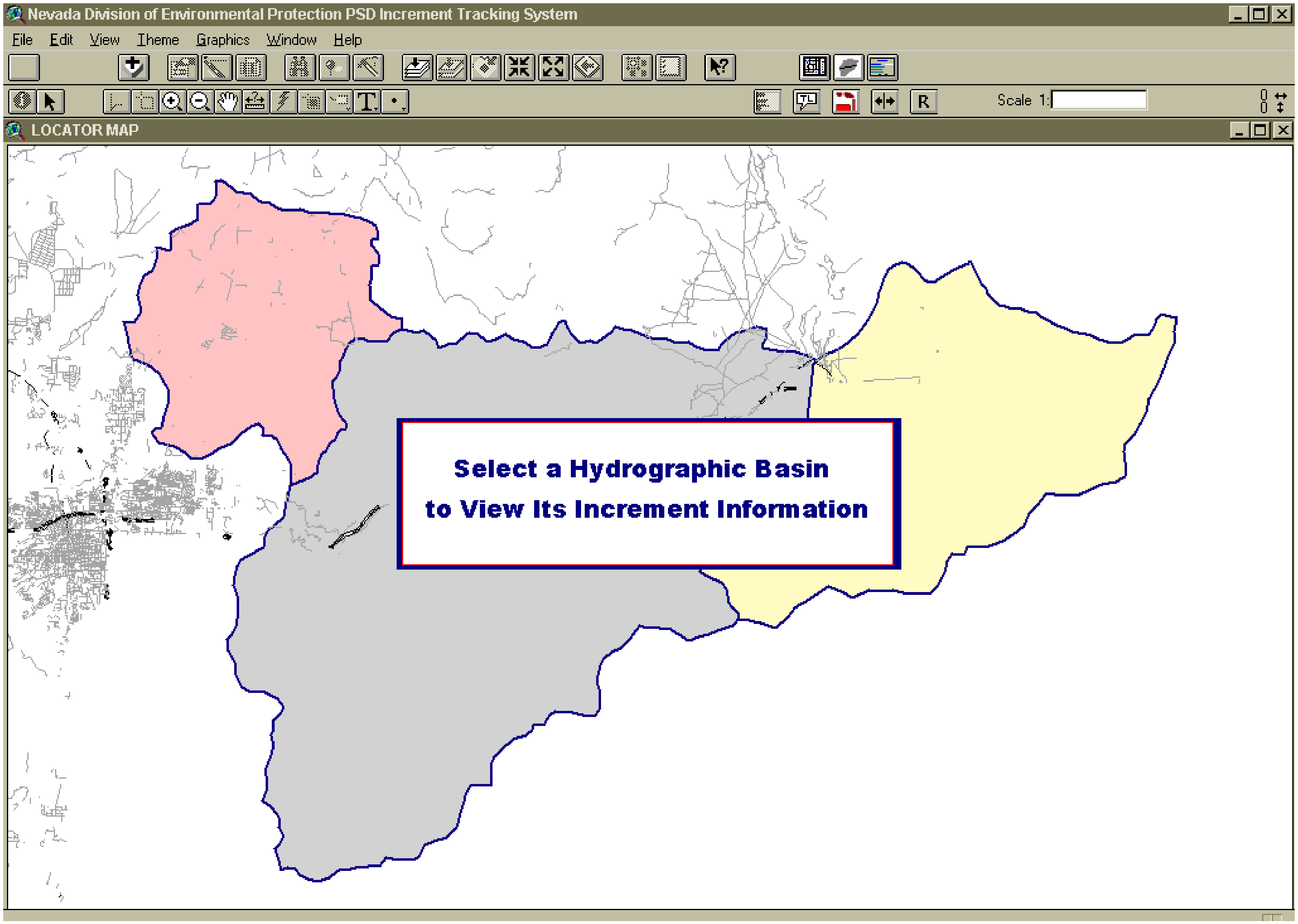


FIGURE 3-7
EDIT AN EXISTING FACILITY



S110400808\b:\project\ndep\psd_study\epa_presentation\epa_report\epa_report_rjh_042703.doc

FIGURE 3-8
BASIN SELECTION SCREEN



The spatial data for the ITS was acquired from several sources, such as the State of Nevada, the USGS, and the Census Bureau. All spatial data was converted to ArcView shapefile format and metadata was created for each theme.

3.3.2 Presenting Data Graphically

The spatial data for each HA are organized and symbolized for the user in a default presentation. The user may use standard ArcView techniques to modify this presentation or create additional graphic displays of the data. Shaded classification maps of emissions data for each 1-km area grid can be created automatically by selecting the **Map Area Results** button (Figure 3-9). By choosing this button the user is prompted to select either total, vehicular, railroad, or miscellaneous area source emissions to the map. When the map is created, the user can modify the symbology using standard ArcView legend editor capabilities.

All data presented on a map can be included in a map composition or layout. To create a custom layout, choose the **Create Custom Map Layouts** button and a new layout based on the features visible in the map view will be created. In addition to the spatial data, the map will include a user defined title, automatically accurate scalebar, north arrow, and NDEP logo.

3.3.3 Presenting Attribute Data in Reports or Facility Attribute Boxes

To create a text report of attribute data for any feature, the user chooses the **Create Report of Attributes** tool and then selects the feature in an active theme for a report. A text report will be created, and Windows Write will open it (Figure 3-10). This report can be printed, or saved to a new file.

Selecting the **Create Facility Information Boxes** tool creates facility attribute boxes for display on a map. After the user selects a tool, instructions appear in a message box after selecting the tool. After drawing a leader line from the feature for which an information box will be created, the user is prompted to choose fields to be included. Data for all facility systems and controls found at this location are presented in a table connected to the feature by a leader line (Figure 3-11).

3.3.4 Adding Facilities

New facility systems can be added to the database using an interface from the ArcView component of the ITS. The location of the new facility may either be selected graphically on the ArcView map, or keyed in using UTM coordinates. The user first selects the **Add or Edit a Facility** tool (Figure 3-12) and then locates the new facility using either method. A data entry form opens in ArcView to allow information about the new facility to be entered, and the new facility is properly linked to other data in the database.

FIGURE 3-9
MAP AREA RESULTS

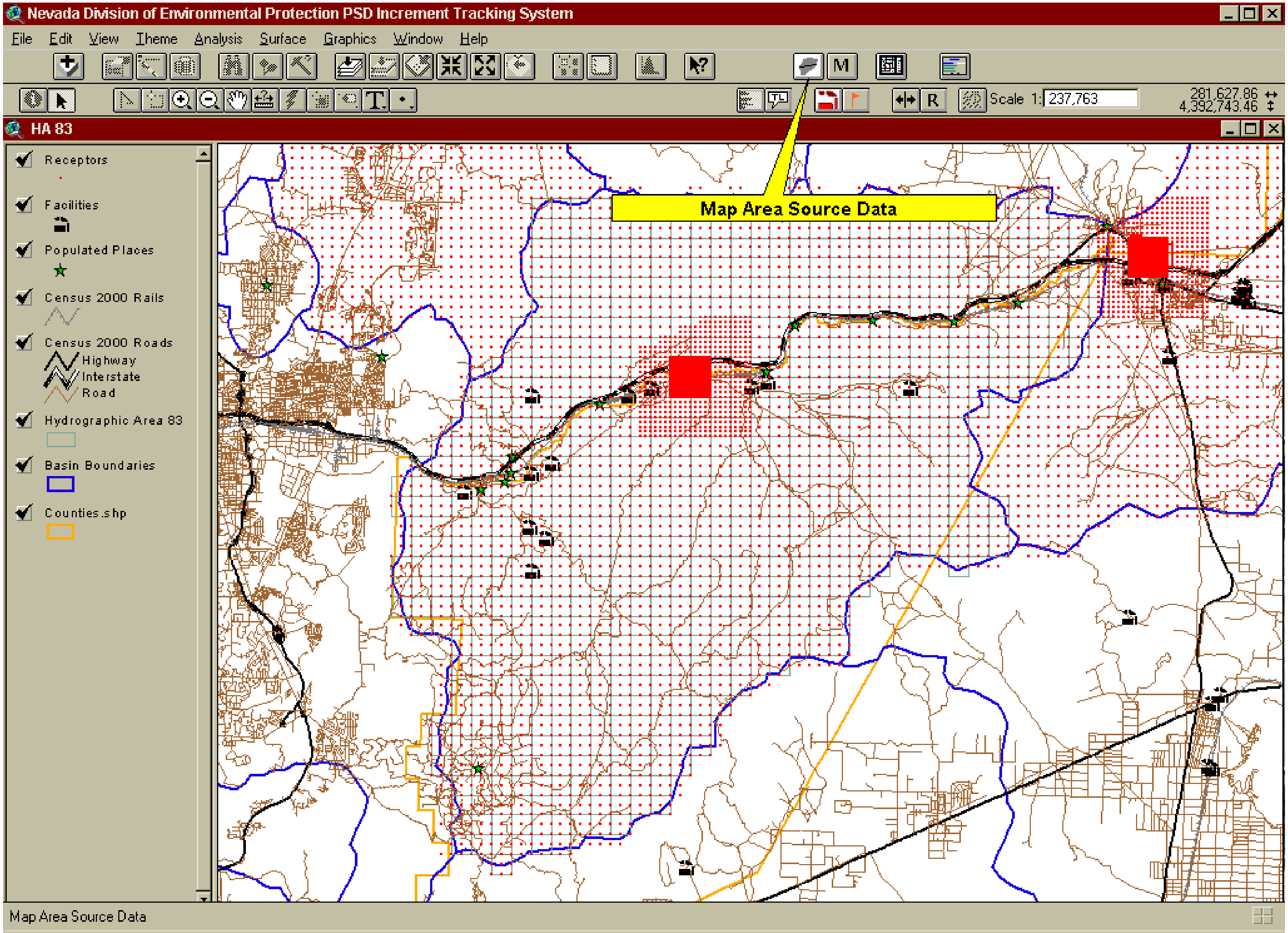


FIGURE 3-10
CREATE A REPORT OF FEATURE ATTRIBUTES

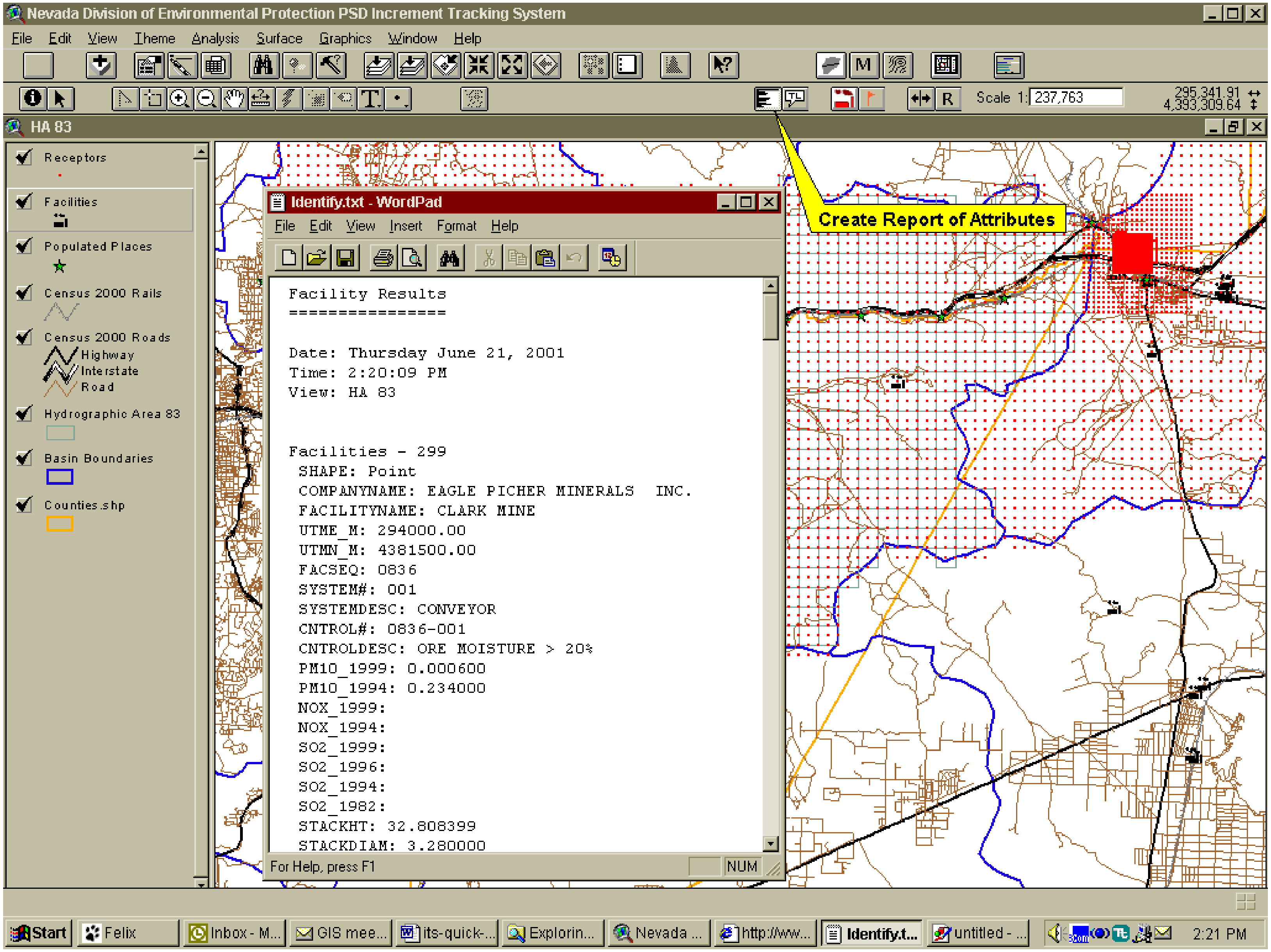


FIGURE 3-11
CREATE FACILITY ATTRIBUTE BOXES FOR MAP DISPLAY

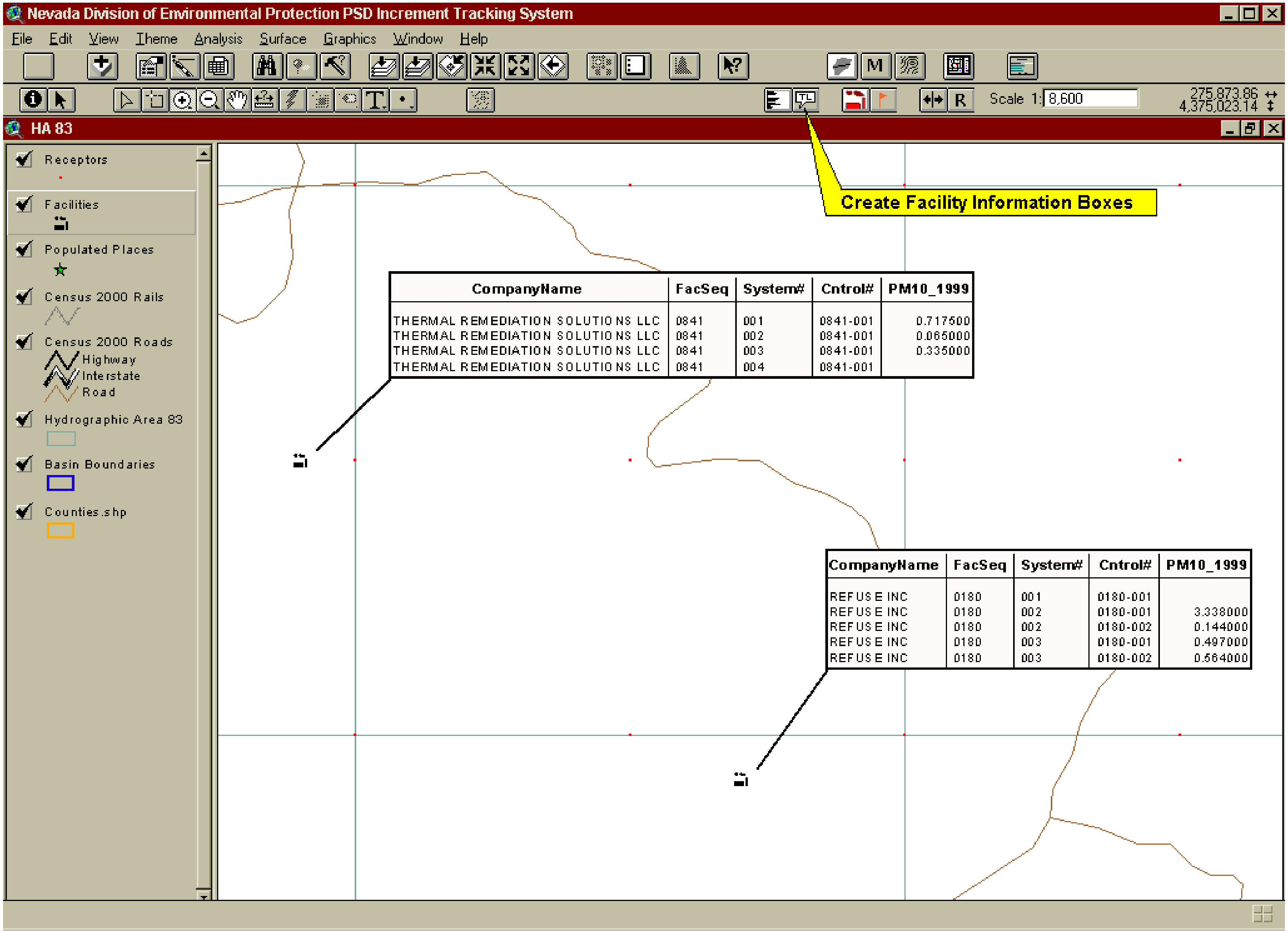
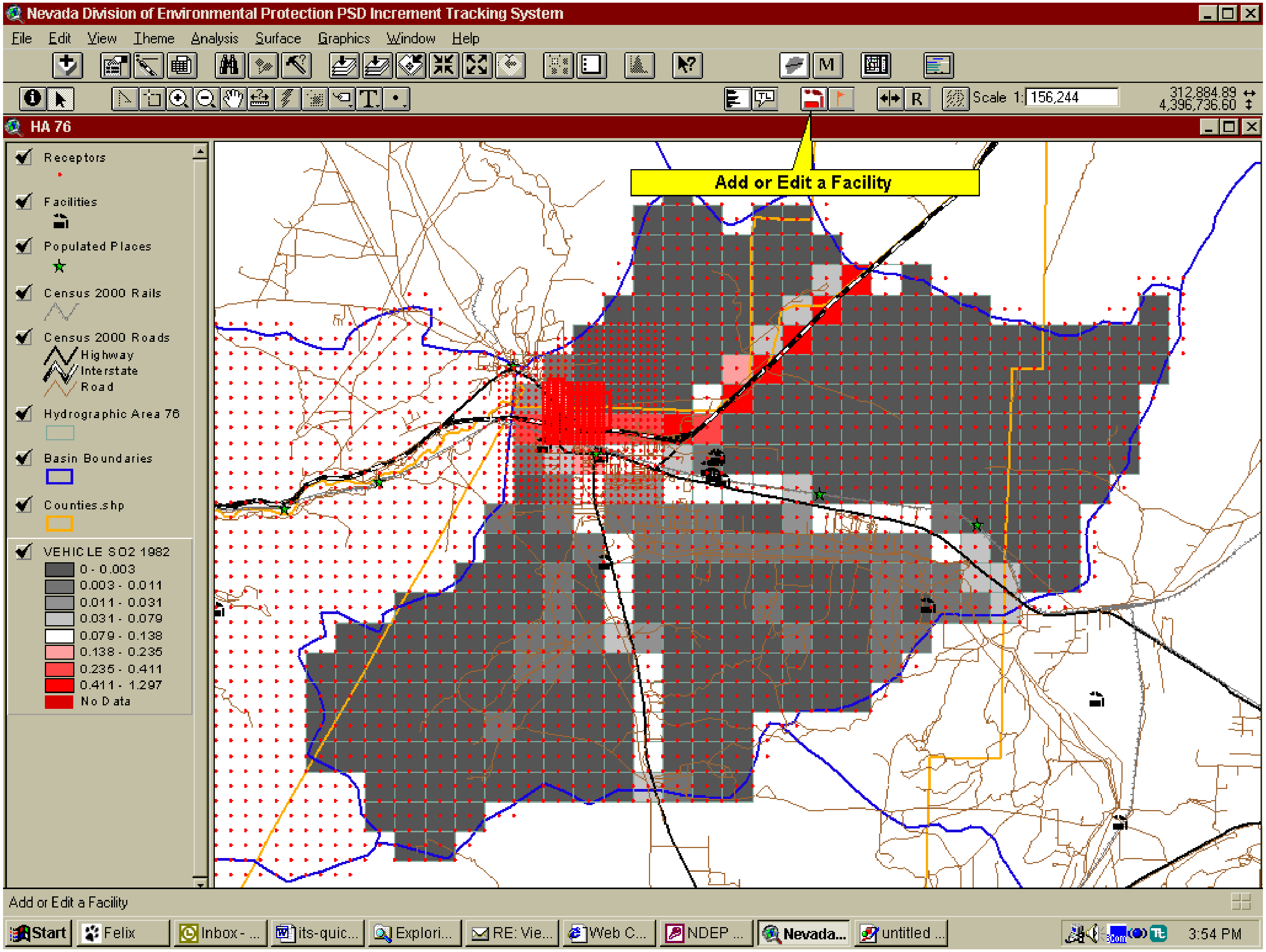


FIGURE 3-12
ADD OR EDIT A FACILITY IN ARCVIEW



This data is automatically be added to the appropriate table in the Access database. Next, a detailed data entry form opens in the Access database. Detailed system and control information must be entered to allow ArcView to map the new facility. The user selects **Quit** in Access after entering the data. It is recommended that comprehensive input of new data is accomplished in the Access component of the ITS.

3.3.5 Editing Facilities

Existing systems may be edited using an interface from the ArcView component of the ITS. A facility may be selected graphically, or from a drop-down list after selecting the **Add or Edit a Facility** tool. Facility data are edited by using a data entry form that will include existing facility information. Typing over the data displayed in the data entry form can easily modify this facility information. It is recommended that extensive editing of the data take place in the Access component of the ITS.

3.3.6 Adding Receptors

New receptors may also be added to the Access database using an interface from the ArcView component of the ITS. The user selects the tool **Add a New Receptor** (Figure 3-13) and chooses the location on the map where the desired receptor is located. A data entry form opens and information about the receptor can be entered. A RECEPTORID must be entered at this point to allow the new receptor to be linked to other data in the database. When data entry is complete the user selects **Okay** to continue. The new receptor appears on the map is available in Access for modeling functions.

3.3.7 Viewing Model Results

Model results stored in Access can be mapped in the ArcView component of the ITS. The user selects the button **Map Model Results** (Figure 3-14) and chooses a set of previously entered model results. A new ArcView theme with each receptor used in the model is then added to the view. The user is then asked if they want to create contours for these receptor model results. Select **Yes** to create contours, or **No** to end.

3.3.8 Creating Model Result Contours

Contours can be created from a model results theme either by creating them directly after mapping model results, or by selecting the **Create Contours from Model Results** button (Figure 3-15). Before choosing this button, the user selects the specific receptors to be contoured in the model results theme using the standard

FIGURE 3-13
ADD NEW RECEPTOR IN ARCVIEW

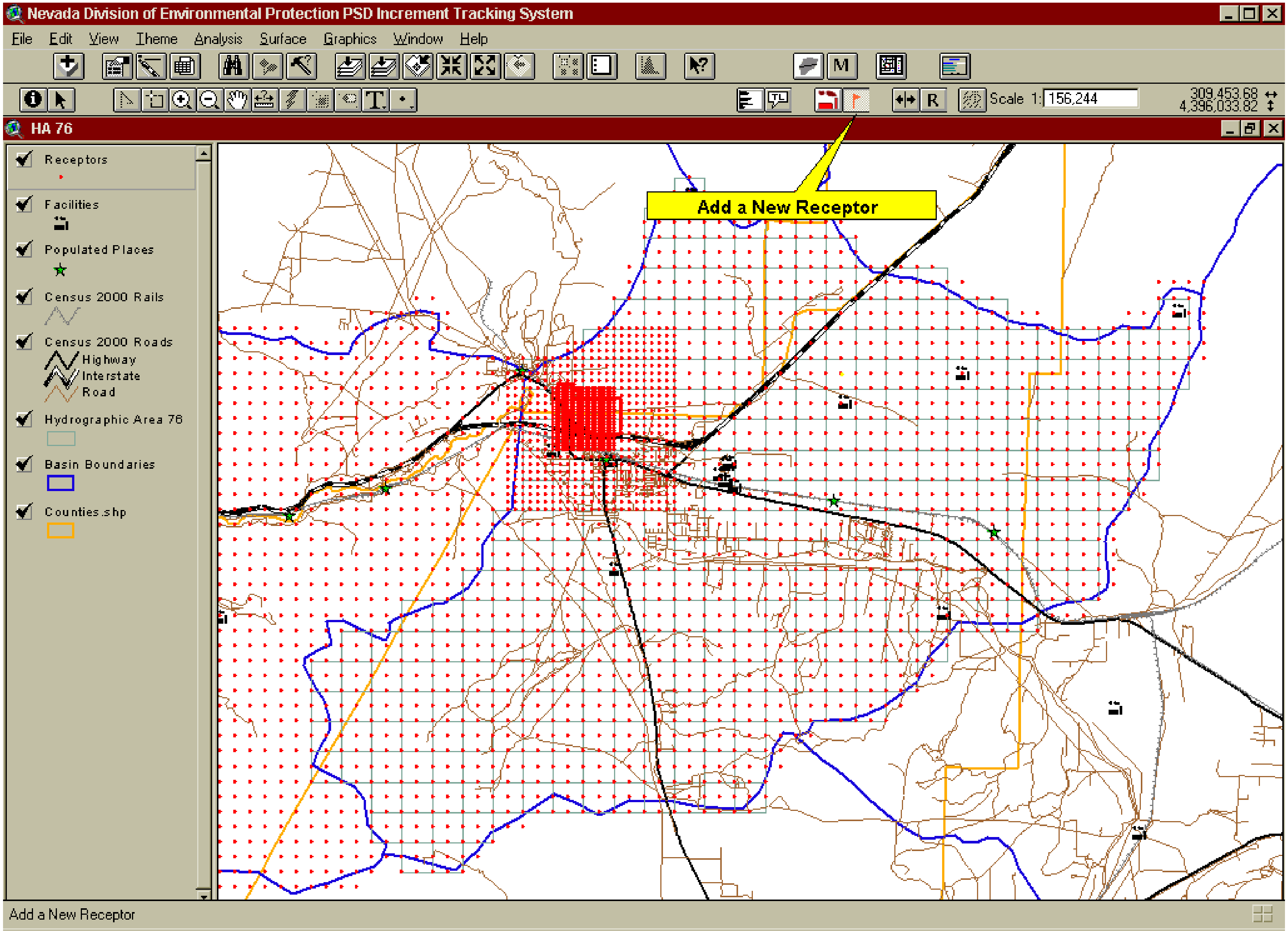


FIGURE 3-14
MAP MODEL RESULTS

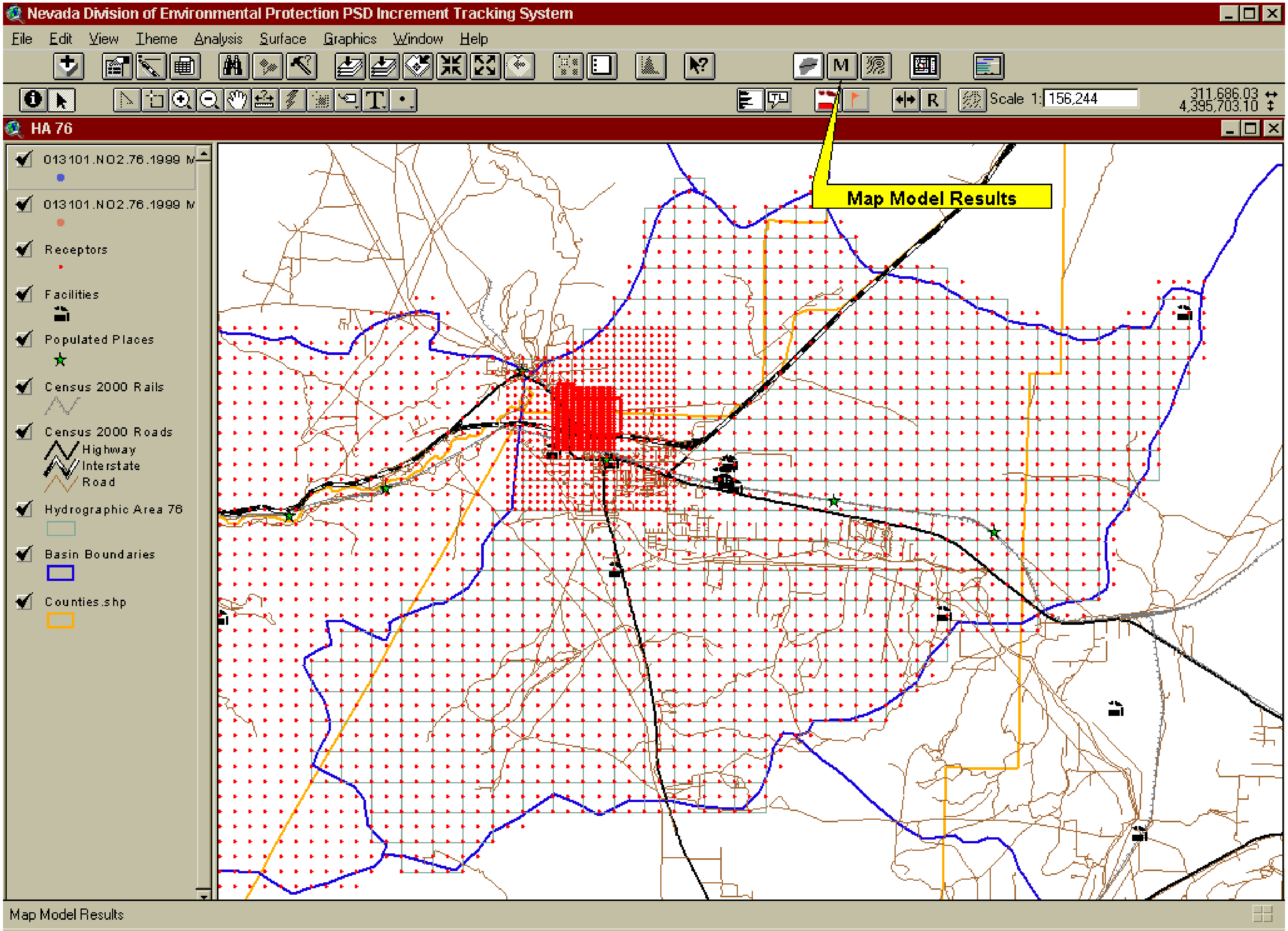
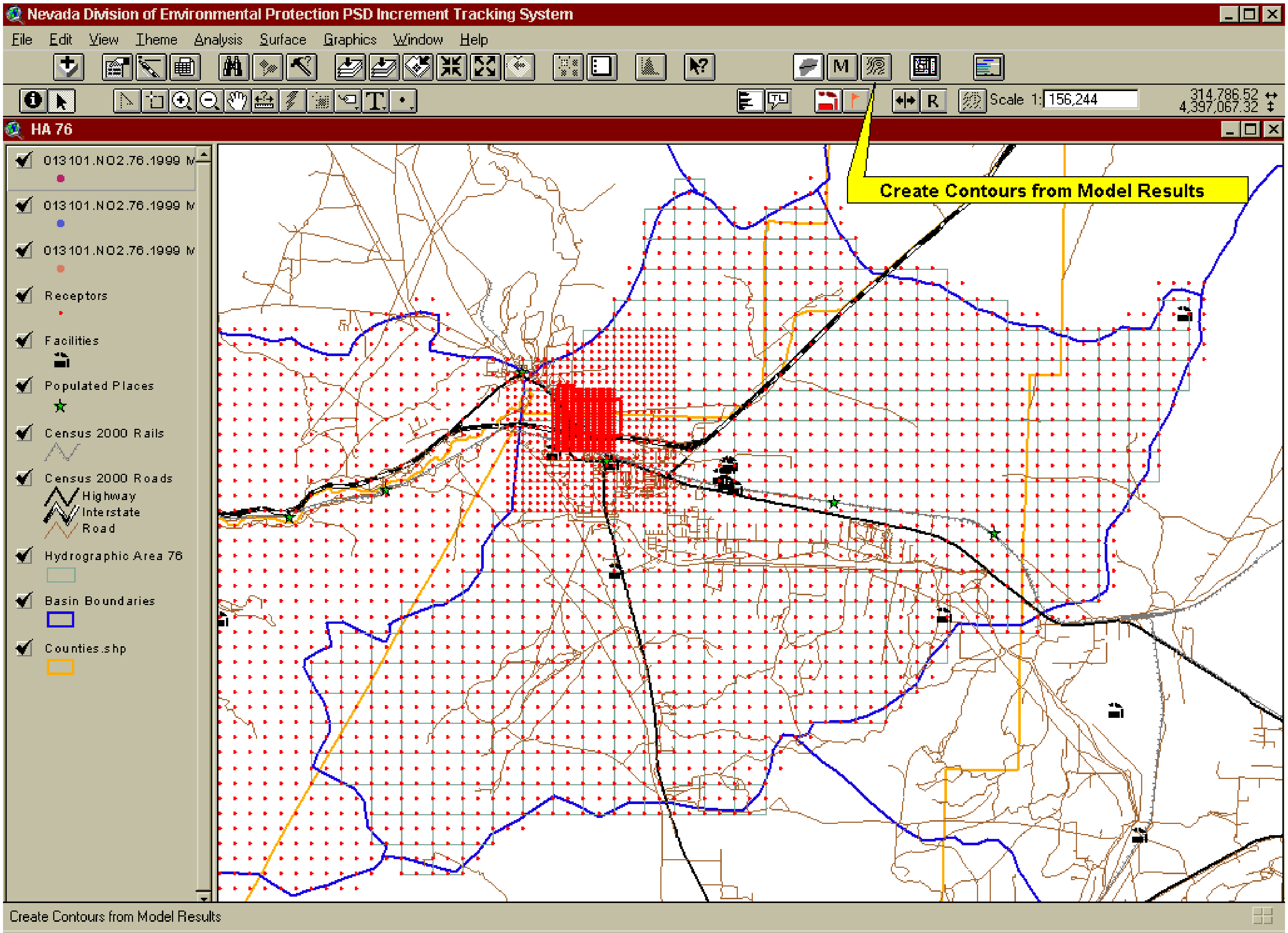


FIGURE 3-15
CREATE MODEL RESULT CONTOURS



ArcView **Select Feature** tool. In the case that all the receptors in the view are contoured, this intermediate step may be omitted. The user can zoom to a scale that displays the proposed contour area. The program will choose an appropriate resolution for the contours based on this scale. The model results theme must be made active. After choosing the button to create contours, a field is selected that includes the values to be contoured. These fields listed include only emission values fields. Finally, a prompt for a contour interval and beginning contour appears. The user should choose these values appropriately.

This contouring program has been simplified from the standard Spatial Analyst contouring program to work efficiently with modeling result data. The standard Spatial Analyst contouring function can be used by selecting the menu items **Surface – Create Contours**.

4.0 SOURCE INVENTORIES

This section describes the methodologies used to develop the NDEP ITS emission inventories, and source types included in the inventories. Source inventories include emission inventories as well as inventories of related source parameters that are required to conduct the Source Impact Analyses for determining PSD increment impacts. Source information used in determining PSD increment consumption needs to be based on the source inventories compiled for the current date and the minor source baseline date for an applicable pollutant, plus modifications that occurred to major sources between the major source and minor source baseline date. Source information in the ITS is developed for each applicable pollutant, HA, and baseline date using data from numerous resources.

The information gathered provides a comprehensive history of stationary sources within Nevada. The AIRS and NET data are used to identify the area and mobile sources (railroad, vehicle, and miscellaneous fugitive emissions) on a countywide basis for the current date and minor source baseline dates.

Actual emissions data are used to the greatest possible extent in developing the baseline date source inventories for NDEP regulated sources. Actual emissions are based on available NDEP records, EPA's AIRS and NET databases, and NDOT records. When actual emission rates are not available or cannot be reliably estimated, potential emission rates are used for baseline data. When the startup date of a stationary source is not available, it is assumed that the source is entirely increment consuming by not including it in the baseline analysis. The assumption that a stationary source is increment consuming if baseline data are not available, results in modeled impacts that maximize predicted increment consumption from that source.

Baseline emission source data represent average actual stationary source operations just prior to the appropriate baseline date, and are based on available records from the closest date prior to the baseline date. In other words, emission data are used from as near to the baseline date as possible where records exist, but before the baseline trigger date. In some cases, the only recorded emission data are two to three years prior to a given baseline date.

Area source emissions caused by railroads, vehicles, and miscellaneous sources also affect the available increment; therefore, the minor source baseline date inventories and the current emission inventory include area source emissions. EPA maintains estimates of these emissions for each county in every state in the AIRData NET database.

4.1 METHODOLOGY

Data searches for stationary sources include the following databases and information sources:

- The NDEP Paradox database
- NDEP, and County historical files
- Nevada Minerals Industry Listings
- State Mines Inspection Reports for the minor and major source baseline dates

The information gathered from these sources provide data for stationary source emissions and dispersion characteristics.

Stationary and area source data for the baseline date are also included in the ITS. These data are stored in the same tables as 'current' data and are identified by year and pollutant. The sections below give more details about stationary source and area source inventories.

4.2 STATIONARY SOURCE INVENTORY

Initial emissions and permitting data for the 'current' year are gathered from the BAPC/BAQP Paradox database. These data are imported into the Access database and mapped to the ITS data table structure. The Access component of the ITS uses BAPC/BAQP's Paradox database structure as its foundation. Facility, system, and emissions data are stored in tables similar in design and content to the table structure found in the Paradox database. Only slight modifications were made to the Paradox structure. For example, emission unit data are incorporated into the control and system information. Keys from Paradox are retained in order to maintain data relationships with the original data.

NDEP and county agency historical files are used to supplement the NDEP Paradox database regarding emission information for permitted facilities. The Nevada Minerals Industry Listings and the State Mines Inspection Reports provide source names and locations of mining operations active during the baseline years. Historical air quality permits and emission inventory reports for facilities in both NDEP and county records provide emission rates and source parameters for stationary source inventories. Major and minor sources are reviewed for a particular HA under major and minor baseline dates. Additionally, major sources within a 50-km radius of the HAs are reviewed for each of the stationary source inventories.

Emissions and source parameter data for all known sources that currently exist comprise the current inventory. The current inventory is based on permitted emission rates and source parameters. It is assumed that a source is increment consuming when information about the startup date of the stationary source is not available. Sometimes facility file records are updated because a new permit or a permit modification that was approved by NDEP since the Paradox database was updated. The emissions changes due to these permitting changes are incorporated into the source inventory for the increment impact analysis.

4.2.1 Stationary Source Data Collection

To establish the stationary source inventory, BAPC/BAQP source data, historical air quality permits, and recent annual emission inventories for $SO_{2,}$ NO_2, and PM_{10} are reviewed. Stationary sources located in a HA are ranked according to permitted facility-wide annual emissions of the triggered pollutant, $SO_{2,}$ NO_2, or PM_{10}. This procedure allows the identification of the stationary sources that are major sources of a particular pollutant. Facility source histories from Title V operating permits are also reviewed to determine permitted emissions. For non-Title V sources, available permits are reviewed for approval dates to identify facilities that should be included in a baseline inventory.

For current scenario emissions, all stationary facilities that are known to be operational and emit $SO_{2,}$ NO_2, and PM_{10} are used. After all stationary sources are accounted for and source inventories for baseline and current scenarios are established, modeling-related source parameter data are gathered for each stationary source. The source parameters include emission rates for each point source, UTM coordinates for emission points, and stationary source fencelines, building dimensions (length, width, and height) for major stationary sources, stack heights, stack diameters, stack gas exit velocities, and stack gas exit temperatures.

The Nevada State Legislature has authorized BAPC/BAQP jurisdiction over all counties in the State of Nevada except for Washoe and Clark Counties, but BAPC/BAQP maintains jurisdiction over fossil fuel-fired steam generating electric plants throughout the state, including those in Washoe and Clark Counties. A search of county files is required for an HA that is partially or wholly in Washoe or Clark Counties, or within 50 miles of the counties. Assistance must be obtained from the county air pollution agency to conduct a file search.

4.3 AREA AND MOBILE SOURCE INVENTORY

Area and mobile source data are not included in the BAPC/BAQP Paradox database. Area source emission data are obtained from EPA's AIRData NET database, which includes information that is pertinent to the emissions study. The NET Tier 1 reports provide annual area and point source emission totals for each county on a pollutant-by-pollutant basis, as well as information about the origin of the data. The report organizes each source into one of 14 major (Tier 1) categories, and further classifies the sources into one of 75 more detailed (Tier 2) categories. Area and mobile sources (such as railroad, vehicle, and miscellaneous fugitive emissions) are identified on a countywide basis. The NET database has been used to track area source emissions since 1985, when EPA promulgated the emissions reporting program (EPA 2003).

Table 4-1 shows the area source categories in the NET TIER data source, and how they have been grouped for the ITS analysis.

NET data are acquired and apportioned to areas using methods described in further detail in subsequent subsections of this source inventory section. Apportioned NET data are stored in the PSD_Area_Sources table in the Access 2000 database.

Area and mobile sources in a HA are assigned to one of three categories: railroad, vehicle, or miscellaneous sources. Railroad emissions are apportioned into 1-km by 1-km grid cells based on the proportion of county railroad miles in the HAs and the total railroad miles traveled annually. Vehicle emissions, including fugitive dust from unpaved and paved roads, are apportioned into the same grid cells based on the proportion of road miles in each grid cell and the total vehicle miles traveled annually in each grid cell. Miscellaneous area source emissions are distributed into the grid cells according to population density. Emissions from railroads, vehicles, and miscellaneous sources are then totaled to give a single emission rate for each 1-km by 1-km grid cell. The following sections explain the calculations used to apportion the area source emissions.

4.3.1 Railroad Source Analysis

Calculating railroad emissions involves a two-step process for each grid cell. The first step is to calculate emissions in the fraction of each county that make up the PSD increment consumption triggered HA. A HA will typically encompass portions of several different counties. It is important to identify the counties through which railroads pass in the HA because the emissions data available from the NET Tier database are organized by county. The second step is to break down the emissions from the portion of each county that makes up the HA even further by apportioning the emissions into 1-km by 1-km grid cells.

TABLE 4-1
NET TIER SOURCE CATEGORIES

Tier I Category	Tier II Category
Railroad Category for Baseline ITS	
Off-Highway	Railroads
Vehicles Category for Baseline ITS	
Highway Vehicles	Light-Duty Gas & Motorcycles
Highway Vehicles	Light-Duty Gas Trucks
Highway Vehicles	Heavy-Duty Gas vehicles
Highway Vehicles	Diesels
Off-Highway	Non-Road Gasoline
Off-Highway	Non-Road Diesel
Miscellaneous	Fugitive Dust
Miscellaneous Category for Baseline ITS	
Fuel Combustion Indus.	Coal
Fuel Combustion Indus.	Oil
Fuel Combustion Indus.	Gas
Fuel Combustion Other	Commercial/Institutional Oil
Fuel Combustion Other	Commercial/Institutional Gas
Fuel Combustion Other	Residential Wood
Fuel Combustion Other	Residential Other
Other Industrial Processes	Miscellaneous Industrial Processes
Waste Disposal	Incineration
Waste Disposal	Open Burning
Off-Highway	Aircraft
Miscellaneous	Agriculture & Forestry
Miscellaneous	Other Combustion

To begin the first step by calculating emissions in the fraction of each county that makes up a HA ($RE_{countyfraction}$), the total rail length in each county (RL_{county}), the length of railroad in the fraction of each county that makes up the HA ($RL_{countyfraction}$), and the total railroad emissions for each county (RE_{county}) are determined. Census data can be used to estimate RL_{county}. Next, $RL_{countyfraction}$ is computed for the HA using GIS applications. RE_{county} is downloaded from the NET Tier database, and data for each pollutant and baseline date are extracted. The following equation shows how $RE_{countyfraction}$ for the HA are calculated. The calculation is repeated for each county in the PSD increment consumption triggered HA.

$$RE_{countyfraction} = RE_{county} \frac{RL_{countyfraction}}{RL_{county}}$$

The second step, apportioning $RE_{countyfraction}$ into the 1-km by 1-km grid cells in the HA ($RE_{gridcell}$), requires the use of $RL_{countyfraction}$, $RE_{countyfraction}$, and the rail length in each grid cell ($RL_{gridcell}$) in a calculation similar to that of the first step. $RL_{countyfraction}$, for each county area is determined for the first step, $RE_{countyfraction}$ for each county area are the results of the first calculation, and $RL_{gridcell}$ are determined using GIS applications. The following equation demonstrates how $RE_{gridcell}$ are calculated.

$$RE_{gridcell} = RE_{countyfraction} \frac{RL_{gridcell}}{RL_{countyfraction}}$$

4.3.2 Mobile Sources Analysis

Apportioning the mobile source analysis for the increment study is a four-step process, including a data collection phase and three sets of calculations. The result of this process allows vehicle emissions for each pollutant to be apportioned into the established 1-km by 1-km grid cells.

Data on vehicle miles traveled (VMT) and countywide vehicle emissions data for each pollutant are both needed for this analysis. First, annual VMT are acquired for Nevada from Federal Highway Administration Highway Statistics publications for the baseline and current years of concern. VMT data are divided into three road types to account for their differing contributions to mobile source emissions: interstate, highway, and arterial street. Next, countywide vehicle emissions data for each pollutant (including fugitive dust from paved and unpaved roads) are gathered from the NET Tier database for the years of concern. Because no emissions data was available for some earlier baseline years, a trend regression analysis based on available emissions data was required to estimate pollutant emissions in each county.

The first set of calculations breaks down VMT into road miles per county, HA, and grid cell. The VMT are also broken down into the three different road types. GIS techniques are used to apportion VMT data collected for Nevada into these area and road type categories. This set of calculations results in numeric values for:

- Interstate VMT for each county
- Highway VMT for each county
- Arterial Street VMT for each county
- Interstate VMT for each HA
- Highway VMT for each HA
- Arterial Street VMT for each HA
- Interstate VMT for each grid cell
- Highway VMT for each grid cell
- Arterial Street VMT for each grid cell

The second set of calculations breaks down countywide vehicle emissions into HA-wide emissions for each road type using ratios. The ratio of HA VMT to county VMT for each road type is multiplied by the ratio of HA VMT per road type to total HA VMT. The following equation shows HA-wide emissions per road type as the product of these two ratios multiplied by countywide emissions to give HA-wide emissions per road type (1).

$$\frac{TotalHAVMT}{TotalCountyVMT} * \frac{HARoadTypeVMT}{TotalHAVMT} * CountyEmissions = HARoadTypeEmissions$$

The third set of calculations results in the final apportionment of all vehicle emissions into the 1-km by 1-km grid cells. A ratio of grid cell VMT to HA VMT is calculated for each grid cell and road type using the numeric values from the first set of calculations. These ratios are then multiplied by the HA-wide emissions for each road type derived from the second set of calculations to yield grid cell emissions for each road type in the following equations.

$$\frac{GridCellInterstateVMT}{HAInterstateVMT} * HAInterstateEmissions = InterstateGridCellEmissions$$

$$\frac{GridCellHighwayVMT}{HAHighwayVMT} * HAHighwayEmissions = HighwayGridCellEmissions$$

$$\frac{GridCellArterialVMT}{HAArterialVMT} * HAArterialEmissions = ArterialGridCellEmissions$$

The following equation shows the emission values in each grid cell for interstate, highway, and arterial streets are summed to calculate the total vehicle emissions in each grid cell.

$$
\begin{array}{ll}
 & \mathit{InterstateGridCellEmissions} \\
 & \mathit{HighwayGridCellEmissions} \\
+ & \underline{\mathit{ArterialStreetGridCellEmissions}} \\
 & \mathit{TotalEmissionsForEachGridCell}
\end{array}
$$

4.3.3 Miscellaneous Sources Analysis

Apportioning the miscellaneous source analysis for the increment study is a four-step process, including one data collection initiative and two sets of calculations, and GIS techniques. The result of this process allows miscellaneous emissions for each pollutant to be apportioned into the 1-km by 1-km grid cells used for railroad and vehicular emissions.

Data for population density and countywide miscellaneous emissions for each pollutant are used in this analysis. To calculate emissions from miscellaneous sources for the 1-km by 1-km grid cells, countywide miscellaneous emissions data are first acquired for each pollutant from the NET Tier database for the current and baseline years of concern. However, if no miscellaneous emissions data are available for an earlier baseline year, a trend regression curve based on available emissions may need to be developed. This best fit curve approach allows the estimation of miscellaneous emissions in the missing earlier years for each county.

To apportion the miscellaneous emissions by population density, census population data is collected for the HA. Census data are available by county and census block. Census blocks are smaller than counties. By using census block data instead of countywide population data to determine population density, the user is able to more closely refine population density in the study area. Census data from the census year closest to the baseline or current year of concern are needed for this analysis.

The first set of calculations breaks countywide population totals down into census block population totals. Missing years of census block values are estimated using countywide population data collected for those years. The ratio of each county's missing year of population to the corresponding available year of county population was multiplied by the applicable available year's census block totals. This allows the estimate of the missing year's population for each census block. The same method is used to estimate totals for population in the 1990 census blocks in the following equations.

$$\frac{Year1CountyPopulation}{Year2CountyPopulation} * Year2CensusBlockPopualtion = Year1CensusBlockPopulation$$

The second set of calculations distribute countywide miscellaneous emissions into each census block for the different baseline or current scenarios. Because countywide miscellaneous emissions are apportioned based on population density, a ratio of census block population to county population is needed. This ratio is then multiplied by the county emissions to give emissions apportioned to each census block in the following equation.

$$\frac{BlockPopulation}{CountyPopulation} * CountyEmissions = BlockEmissions$$

Using GIS techniques, the 1-km by 1-km grid cells are overlaid onto a map displaying population and emissions for each census block. Each grid cell is intersected with a specific census block, and the corresponding percentage of population was allocated to the grid cell. Emissions from miscellaneous sources are then distributed according to population density for each grid cell using GIS methods.

4.3.4 Fugitive Dust Refinements

To obtain a complete emission inventory, fugitive emissions resulting within the property boundaries of stationary sources and area source emissions outside of stationary sources need to be accounted for. Historically, permitted emissions from stationary sources in Nevada are limited to process emissions. Process emissions include particulate emissions that result from material handling operations, including conveyor transfer points and bin loading operations. Fugitive emissions are generally not included in the permit and are therefore not included in the data base of emissions from stationary sources. However, they still consume increment. Fugitive emissions at stationary sources include windblown dust from storage piles, material handling operations that are not included in the process emission, and entrained road dust from process related (i.e. haul road) traffic on both paved and unpaved roads on site within the plant boundaries. Fugitive emissions would also include “tailpipe” emissions from the locomotives and/or haul trucks and emissions from non-road sources such as cranes, front loaders dozers, and graders.

For area sources, initial investigations have determined that the category contributing the largest amount to the total statewide emissions of area source particulate emissions results from the miscellaneous category, and the majority of these result from the “fugitive dust” subcategory.

To refine the fugitive dust estimates for the ITS, there are two areas of recommendations: emission estimates and allocation or distribution of the emissions.

Emission Estimates

In accordance with the PSD rules, fugitive dust resulting from stationary source operations and area sources will affect the available increment in areas where the minor source baseline has been triggered. Therefore, emission estimates in areas where the available increment must be tracked should include fugitive dust.

Many states are in the process of refining estimates of the fugitive dust emissions resulting from area sources and stationary sources. In addition, EPA is currently in the process of revising some of the fugitive dust emission factors. The paved road factors were revised in October 2002, and the draft revision to the unpaved road section (http://www.epa.gov/ttn/chief/ap42/ch13/draft/d13s02-2_oct2001.pdf) is currently being reviewed.

EPA may propose an off-road emission factor section in the near future. Currently EPA, for regional modeling efforts, EPA has assumed a "crustal factor," which essentially discounts the fugitive dust emissions by 75% to represent transportable emissions. This will need to be reviewed for applicability after any revised emissions factors are developed.

Emission estimates can be improved if additional information (such as site specific information) can be developed. For example the unpaved road emission estimate requires information on the silt content of the road surface, the mean vehicle weight, the surface moisture, and the mean vehicle speed. Similar data could be used to develop more appropriate factors for paved roads as well. For example, there is concern regarding the potential for double counting on low silt content high volume road surfaces such as interstate highways. The emissions may be double counted if emissions estimates are made using Mobile 6 (which counts particulate from the engine exhaust brake linings etc.) and AP-42 which is a "total exposure" estimate.

Allocation of Emissions

The allocation of the emissions can be critical to the determination of increment consumption. It may be possible to acquire additional information in specific areas that would improve assumptions related to emission allocation. For example, if information was available concerning the total miles of unpaved roads and the miles in a specific grid square, this datum could be used as a surrogate to allocate the fugitive dust emissions. This would allow an area to recognize the credit associated with the number of unpaved roads that have been paved since the baseline date. Similarly, areas that have created additional miles of unpaved roads would be allocated additional emissions.

5.0 AIR QUALITY MODELING

To determine the available increment, air quality dispersion modeling is completed for each PSD triggered pollutant in a HA. The results from modeling each emission inventory scenario are compared with modeling results from the current situation for each HA and pollutant. Although there is the potential to use alternative models, the ITS has been developed by the State of Nevada to use the American Meteorological Society/EPA Regulatory Model Improvement Committee Dispersion Model (AERMOD). This model was selected because EPA is in the process of adopting this model for regulatory use, and it is expected that this model will become the primary model for this type of analysis. The algorithms AERMOD uses to model terrain effects are more complex than in the Industrial Source Complex Short-Term Model Version 3 (ISCST3), which until recently, has been the EPA dispersion model of choice.

Air dispersion modeling is conducted to assess the SO_2, NO_2, and PM_{10} PSD increment available in the appropriate HA. The modeling identifies portions of HAs where the PSD increment has been expanded or consumed since the effective baseline dates.

The ITS allows for the calculation of increment consumption by using an “unpaired in time” analysis. This approach is a departure from EPA-recommended procedures for increment analysis. EPA recommends that concentration comparisons from current to baseline years use a “paired in time” analysis with both baseline and current impacts using the most recent meteorological data. This approach might be reasonable for certain situations. For instance, when meteorological data is not available from the baseline year, the concentrations values for the baseline year can be generated from the same meteorological data set as the one used to generate concentrations from the current year. In this instance the concentration comparison are “paired in time” when using the same meteorological data. However, when data are available to match the baseline source inventory with concurrent baseline meteorological data, an “unpaired in time” analysis can be more appropriate to represent true changes in impacts between baseline and current years. This “unpaired in time” approach is more fully addressed in Section 5.3.

The following sections discuss the model selection, modeling methodology, model analysis using “unpaired in time”, model setup, and model application.

5.1 MODEL SELECTION

Because there are significant terrain features in many of the HAs triggered for PSD increment impacts and used in studies to date, a model suited for addressing complex terrain issues is essential. The

Industrial Source Complex Model (ISC3) was eliminated from consideration because it is not able to address complex terrain as well as other models considered. The enhanced Complex Terrain Dispersion Model (CTDMPLUS) has been used for complex terrain modeling in the region, but is cumbersome to run and must be used in conjunction with another model for simple terrain applications. After considering the available options, the "next-generation" dispersion model AERMOD was selected for use in the ITS. Since the dispersion modeling is accomplished "outside" of the ITS, the selection of the dispersion model can be altered. For example ISC or AERMOD Prime can be used when the situation warrants.

Although alternative dispersion models including AERMOD-PRIME can be used, this analysis describes the selection and use of AERMOD. This model combines the ability to address both complex terrain and simple terrain issues, and has improved dispersion algorithms for addressing boundary-layer meteorology. It is currently in the process of official EPA approval for regulatory analysis, and is now being used in several states for compliance modeling. On April 21, 2000 the EPA proposed revising the *Guideline On Air Quality Models* (40 CFR, Part 51, Appendix W) to replace the ISC3 model with AERMOD as the preferred model for many air quality impact assessments including complex terrain applications. It is expected that AERMOD will replace ISC3 as the preferred dispersion model for evaluating potential impacts from industrial sources within a 50 km radius of the source.

AERMOD is a Gaussian plume dispersion model that is based on planetary boundary layer principles for characterizing atmospheric stability. The model evaluates the non-Gaussian vertical behavior of plumes during convective conditions with the probability density function and the superposition of several Gaussian plumes. AERMOD includes three components: AERMAP is the terrain preprocessor program, AERMET is the meteorological data preprocessor, and AERMOD includes the dispersion modeling algorithms.

Use of AERMOD for the ITS has two distinct advantages. The first advantage is that AERMOD uses improved model algorithms that more closely simulate plume dispersion in the atmosphere than many other models; and the second advantage is that modeling data developed for ITS studies will not become outdated when AERMOD is officially recognized as the standard model for PSD increment applications.

After concluding that AERMOD was the model best suited for use in the ITS, NDEP requested and received approval for its use from EPA Region 9.

5.2 MODELING METHODOLOGY

The dispersion modeling analyses are performed to estimate the PSD increment consumed or expanded from industrial and other pollutant emission sources in a HA. Modeling is performed to evaluate incremental impacts of NO_2, SO_2, and PM_{10}, as triggered in the separate HAs, for all applicable averaging periods. The applicable averaging periods and associated PSD increments addressed through the ITS are shown in Table 5-1. As part of the dispersion modeling effort, there may be reason to update or refine emission estimates for sources in the vicinity of a proposed new project. Guidelines for preparing and documenting proposed refinements to the existing inventory will be similar to the guidelines and documentation used to establish the current inventory. The ITS will be used in the assessment and review of new permit applications, to determine if the applications can be approved. Following the approval of a new source application, the information will be added to the inventory information maintained in the ITS.

TABLE 5-1
PREVENTION OF SIGNIFICANT DETERIORATION INCREMENTS

Averaging Period	Prevention of Significant Deterioration Increment (μg/m^3)		
	NO_2	SO_2	PM_{10}
3-Hour	N/A	512	N/A
24-Hour	N/A	91	30
Annual	25	20	17

Notes:

N/A Not applicable
μg/m^3 micrograms per cubic meter

Separate model runs are executed for each HA, each PSD increment triggered pollutant, for both the baseline year and the current year emission inventories. The modeling is completed for short-term and long-term averaging periods as applicable; and for each year of meteorological data processed.

Model runs use source inventories of PSD triggered pollutants as described in Section 4.0. Data from all known sources that were operating as of each baseline date are included in the baseline year modeling runs. Emissions from all applicable sources operating as of the current year being studied are modeled in the current year modeling runs. Output files from these two sets of modeling are post-processed (as discussed further in section 5.6) to subtract baseline year impacts from current year impacts, resulting in PSD increment impact. This methodology provides output that can account for PSD increment expansion as well as increment consumption.

When conducting modeling for increment tracking, all PSD increment consuming and expanding sources located in the specified HA are included in the analysis. In addition, all PSD increment consuming and expanding emissions from major stationary sources within 50 km of the HAs are included in the analysis.

5.3 NET IMPACT ANALYSIS METHODS

When available, meteorological data for the baseline year are used to determine ambient air concentrations resulting from the baseline sources. The dispersion modeling results for the baseline sources, provide the appropriate concentration for comparison (e.g. second highest modeled impact at each receptor for averaging times of less than annual). Current meteorological data are used to estimate ambient impacts resulting from the current source emissions. The results of the current source modeling report a similar modeled concentration for each averaging time required for comparison to the increment limits. The results are compared (using post processing) on a receptor-by-receptor basis to determine the net impact level, regardless of the time when the baseline or current impacts occurred. The comparison of these data use a methodology referred to as "unpaired in time", and is described further in section 5.3

When adequate meteorological data is not available for the baseline date, the "current" meteorological data are used to estimate the ambient concentrations associated with the baseline emissions as well, and the results are compared directly by using the same averaging period at each receptor. When the same meteorology is used for both the baseline and current emissions, the analysis will be done using the "paired in time" methodology as described below.

5.3.1 Paired In Time

There are several ways to determine the net effect at a specific receptor especially for averaging periods less than annual. EPA's method as described in the *New Source Review Workshop Manual: Prevention of Significant Deterioration and Nonattainment Area Permitting* is to do a net emissions evaluation and model the net emissions (EPA 1990). As long as the baseline and current source parameters are the same, this is the equivalent to subtracting the baseline concentration from the current concentration at each receptor location, for each applicable averaging period. SO_2 is evaluated on an annual, 24-hour, and 3-hour basis and PM_{10} is evaluated for annual and 24-hour periods. For the short-term impacts, less than annual, baseline concentrations are subtracted from current concentrations at each receptor on an averaging period-by-averaging period basis. The resulting differences are then sorted to find the second highest difference of all the "paired" days. These are referred to as "paired" because the baseline and current impacts being used to get the net PSD increment impacts are compared for the same averaging period. The second-highest difference is then compared with the PSD increment. This method of computing the increment is referred to as a "paired in time" calculation, because it computes the difference between current and baseline concentrations on a period-by-period basis and the concentrations at each receptor are therefore "paired in time."

This methodology was developed by EPA primarily for New Source Review which typically focuses on a single source or single facility. Even if there are several sources that are all close geographically, compared with receptor locations, (as would be the case with multiple units at the same plant), the analysis is not greatly affected by the differences that are prevalent in an analysis of widespread sources.

5.3.2 Unpaired In Time

In the ITS, the effects of many sources of emissions spread over a large geographic area are being analyzed. The "paired in time" analysis can provide overly conservative results when current conditions represent a significant change from the sources that existed on the baseline date. For example, if a large source that existed on the baseline date, was subsequently removed and a much smaller source with one half the emissions and a slightly shorter stack was constructed at a nearby location, a smaller impact would be generally expected. This would result in a net benefit to the air quality in the region. Using the "paired in time" analysis, however, this could still be modeled as a net increment increase, possibly even an exceedance. It is reasonable to assume that the highest second high 24 hour average concentration calculated for the new source is smaller than the impact of the baseline source. However, because of the shorter stack, the impact from the new source occurs at a location closer to the facility than the baseline emissions. Under this scenario, for a particular time period, the maximum concentration for the new source occurs at a different location than the maximum location for the baseline source. For instance, the location of the maximum impact from the new source could occur at a location that was affected little by the baseline source, resulting in increment consumption. Thus, an increment exceedance could be predicted for the short term averaging period, even though the air quality in the area has improved.

The elimination of the older source actually created a net benefit to the air quality of the region. But because these sources do not affect the same receptor under the same meteorological conditions, the short term analysis (if "paired in time") can demonstrate significant deterioration of the air quality. A "paired in time" analysis is even less credible if separate meteorological data sets are used for the baseline and current periods.

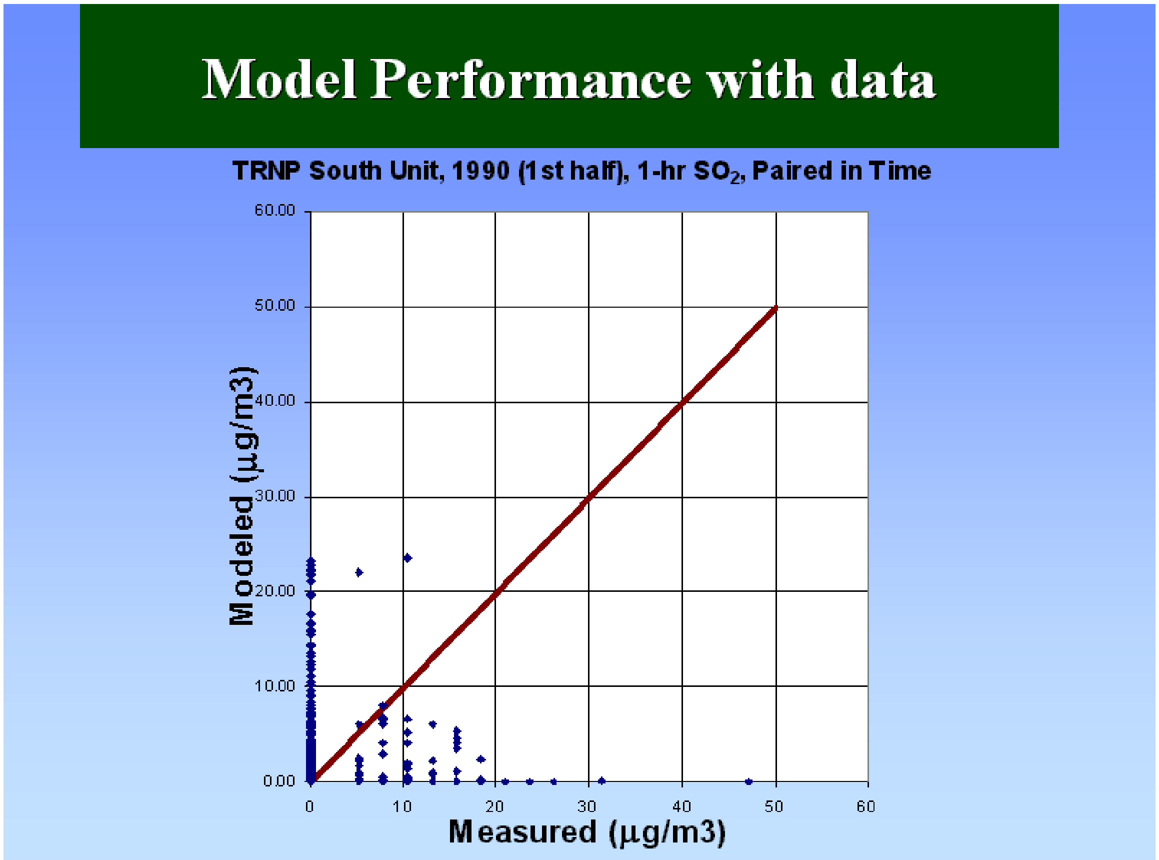
An analogy of this situation can be described using rainfall for two different years. If in one year, 40 inches of rain were recorded at a rain gauge, but in year two only 4 inches were recorded, it would be concluded that the second year is less rainy. However a comparison of the short term (i.e. peak 24-hour rainfall) can also be considered. Examination of the rainfall data indicates that the rainiest day occurred on April 7 of year one, when 2 inches of rain was recorded in 24 hours. The rainiest day in year two was May 5 when 0.5 inches of rainfall was recorded. Based on this, the peak 24 hour rainfall would be considered less in year two. However, using the “paired in time” analysis, if no rainfall was recorded on May 5 of year one, then 0.5 inches received in year two would be considered a significant increase in rainfall on that date (May 5). Based on this, a maximum incremental increase of 0.5 inches of rain was received at this location from year one to year two. Thus, even though year two is generally less rainy than year one, the rainfall for May 5 shows an incremental increase from year one to year two. The “paired in time” analysis results in an assessment that, for widespread and changing emissions, may demonstrate receptors with large increment expansion, and areas with large increment consumption, and will rarely recognize anticipated reductions to the increment.

Another level of this analysis is based on the relative accuracy of the model itself. It is widely accepted that modeling is a valuable tool to predict ambient concentrations, however it is also widely accepted that the accuracy of the model is not precise in predicting the location of the maximum concentration. Similarly, the models that are widely used, including ISC and AERMOD, are often referred to as “lighthouse” models because, when the wind blows in a specific direction, the plume is assumed to be instantly and totally in that direction, similar to the beam of light from a lighthouse. This can create significant differences in actual concentrations compared to modeled concentrations. Most model comparisons have shown that the data must be “unpaired in time” to demonstrate acceptable performance when compared with measured concentrations. The model may be able to reasonably predict a distribution of concentrations over the course of a year, but it typically cannot accurately predict the concentration occurring at a particular time and location.

In recent testimony presented in North Dakota (Winges 2002) a brief model evaluation was presented using data for the year 1990. In this simple comparison, model predictions for “current” conditions using 1990 meteorological data were compared to measured concentrations at the Painted Canyon monitoring site in the South Unit of the Teddy Roosevelt National Park (TRNP). Only the first 6 months of 1990 was used because the monitor was shut down after the end of June in 1990.

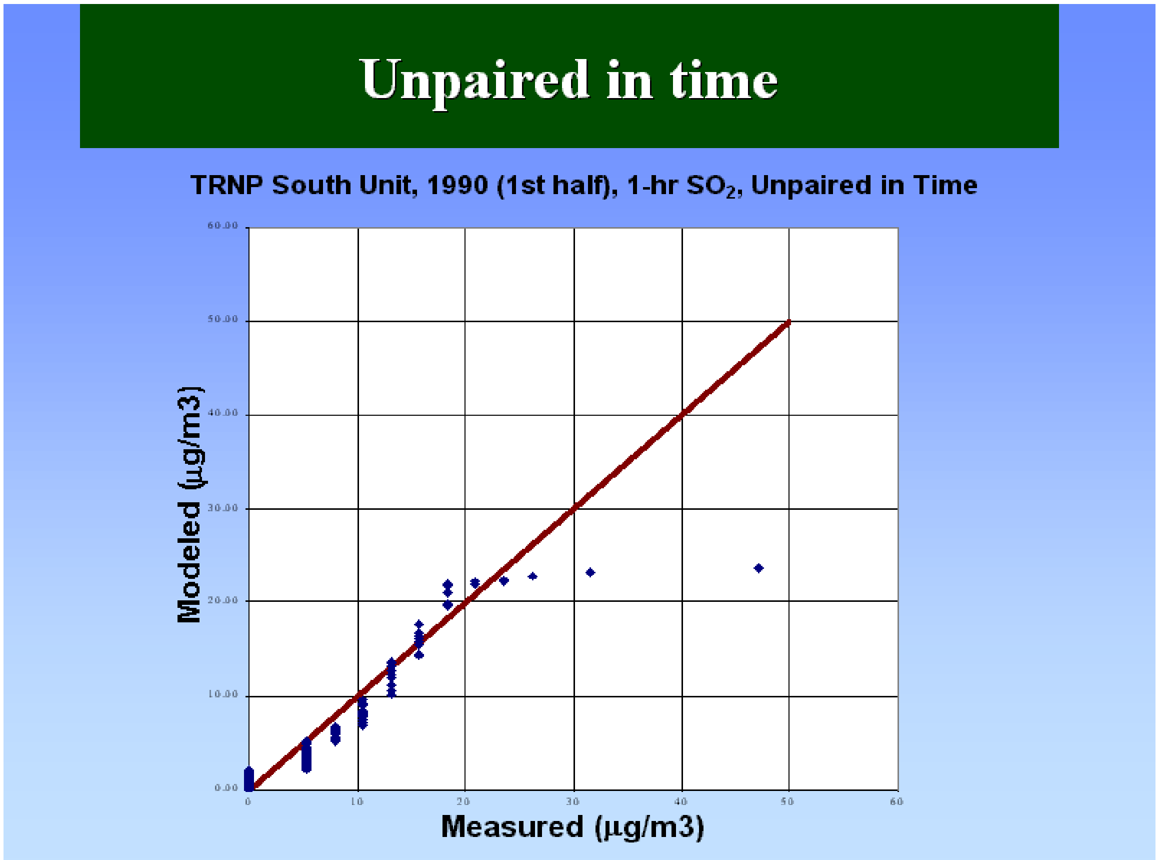
In this testimony, model predictions were compared with measured data. Measured data are placed on the X-axis of the chart while model predictions are placed on the Y-axis. If the model results correlated perfectly, all the data would plot along the diagonal line shown in the figure. When the model prediction is not consistent with the measured data, the points appear scattered about the diagonal. The degree of scatter is indicative of the performance of the model: significant scatter indicates poor performance; data plotted closer to the diagonal indicates good performance.

FIGURE 5-1
MODEL PERFORMANCE WITH DATA



The Figure 5-1 shown above is a plot of the model results when "paired in time" with the monitored data. The correlation is very poor. For the highest measured concentration of 47, the model predicted zero. Similarly for the second highest, and several of the highest measured values, the model predicted zero. Also, there are many instances when the model predicted concentrations to be high, and the measured data was actually zero. This finding is consistent with what other model evaluations have shown. Even the best model available cannot predict the time and locations when the highest concentrations will occur.

FIGURE 5-2
UNPAIRED IN TIME



In Figure 5-2 shown above, the highest measured concentration is plotted against the highest modeled concentration and the second highest against the second highest and so on, regardless of when these peaks occurred. This is referred to as "unpaired in time." The correlation of these data is high, with only a few measured points recorded as higher values that was predicted by the dispersion modeling.

This comparison provides a visual demonstration that the model provides a good correlation with the magnitude of the ambient concentration, but does not accurately predict the time and location of the impact. For any given location, the model can only predict a statistical distribution of concentrations that may be a reasonable approximation of the actual distribution. This is not true for an analysis considering the same time and location. For instance, second highest value in the measured data may be in January, while the second highest modeled concentration may be in July under totally different conditions.

For the ITS, when meteorology data is available for the baseline period, an "unpaired in time" methodology was used to determine increment values. The "unpaired in time" analysis eliminates emphasis on specific time-bound increment results while maintaining the spatial component of the increment analysis. In using this methodology, baseline and current impact results for each applicable time period at each receptor must be determined. The second highest modeled impact at each receptor is determined from the baseline results, and the second highest modeled impact at each receptor from the current results is also selected. Therefore, even for short averaging periods for each year of meteorological data there is one baseline scenario result and one current scenario result associated with each receptor (highest second-high value). The highest second-high baseline impacts at each receptor may or may not occur at the same time of the year as the highest second-high current impacts. The highest second-high baseline results occurring during the year are subtracted from the highest second-high current results on a receptor-by-receptor basis, which gives "unpaired in time" increment results, and a better representation of the actual change in air quality at that receptor.

5.4 MODEL SETUP AND APPLICATION

The AERMOD model contains three modules: two pre-processors and the dispersion model. Model receptors are developed with the AERMAP pre-processor, meteorological data are developed with the AERMET pre-processor, and the model algorithms are applied with AERMOD.

The most recent appropriate AERMOD, AERMAP, and AERMET model code files can be obtained from the EPA website. The EPA website also has AERMOD executable files available, but because array sizes in the FORTRAN code needed to be increased to handle the large number of sources and receptors, the FORTRAN code was recompiled using a FORTRAN compiler consistent with the same program used by EPA.

Applications of AERMOD, AERMAP, and AERMET are discussed in the following sections.

5.4.1 AERMAP

The terrain preprocessor, AERMAP, extracts receptor elevation data from USGS Digital Elevation Model (DEM) files for use as input to AERMOD. All spatial data for the study area, including the DEMs should be based on North American Datum of 1983 (NAD 83) as described in the AERMAP user's guide.

A runstream file for AERMAP is created in accordance with the structure and syntax rules of the program. The selected DEM files and the receptor grids are external inputs referenced in the AERMAP runstream file.

Upon successful completion of the program run, a text output file containing a receptor elevation for each receptor coordinate in the receptor grid files is generated by AERMAP. In addition, AERMAP generates a height scale for each receptor. A height scale is a measure of the height and distance of the local terrain feature that has the greatest influence on dispersion for that receptor.

Separate dispersion model receptor grids are generated with the AERMAP software for each HA. The receptor grids cover the entire area of each HA, with individual receptors located 500 meters apart. Additional model receptors can be added as necessary. Where available, additional receptors used in previous studies surrounding large industrial sources have been added. These receptors generally extended 3 km from each major stationary source with 100-meter receptor spacing up to 1 km from the sources, and 250-meter receptor spacing from 1 to 3-km from large sources.

Receptors located inside stationary source fencelines are not eliminated from the initial modeling analysis. In accordance with the EPA New Source Review Guidelines, an emission source does not consume PSD increment within its own fenceline (EPA 1990). Therefore, the model results at receptors inside property fencelines may not represent accurate modeled increment consumption values, since they erroneously include emissions from the facility itself. The model calculates the contribution from each source and therefore the information is available to subtract out the concentration due to the sources inside the fenceline. In cases where exceedences are initially predicted inside fencelines, the results can be refined, using post-processing, to eliminate contributions from the sources within their own fenceline.

5.4.2 AERMET

The meteorological data pre-processor AERMET is used to develop meteorological input data for the AERMOD modeling analysis. The AERMET software processes surface meteorological data and twice-daily upper air sounding data into the proper format using a three-stage process. The first stage extracts the data and administers several data quality checks. The second stage merges the data, and the third stage estimates required boundary layer parameters and writes the data in a format readable by AERMOD.

Preferably representative onsite meteorological data for each HA are used in a modeling analysis and processed into model-ready format using AERMET. An additional surface dataset collected from a nearby National Weather Service (NWS) station may be required as input to AERMET. This dataset may be used to substitute for any missing values from the onsite data, and to provide additional information for AERMET processing. The final surface data requirement includes estimates of the albedo of the ground, Bowen ratio, and surface roughness. These input values are estimated using guidance in the

User's Guide for the AERMOD Meteorological Preprocessor (AERMET). The last input data requirement for AERMET is upper air sounding data collected twice daily. Sounding data are obtained from the National Climatic Data Center (NCDC), and include upper air soundings from a representative nearby site for the years being processed.

NWS Surface Data

AERMET is designed to extract NWS surface data from several different formats including CD-144, SCRAM, and SAMSON. For many years, NCDC's standard data storage format has been CD-144. However, NCDC no longer uses this format and recent data are stored in TD-3280 format, which is not easily converted to a format usable by AERMET. Newer surface data, stored in the new format, must be converted to CD-144 format. NWS data may not include a full set of values for opaque cloud cover. However, AERMET uses these values, and any missing data must be estimated from other variables collected for each hour, including total cloud cover and present weather. After NWS surface data are converted to CD-144 format, they are extracted, quality checked, and merged with quality checked on-site data.

NWS Upper Air Data

Nearby NWS upper air sounding data are obtained in TD-6201 format. These data are extracted by AERMET, quality checked, and merged with the surface datasets.

After all three datasets are merged as necessary, the final processing stage is executed to produce the model ready data. This final stage calculates boundary layer parameters that are subsequently used by AERMOD. The AERMET software has been modified to allow for missing data in the upper air soundings.

5.4.3 AERMOD

AERMOD is run using the regulatory default mode. Emission sources, model receptors, and meteorological data are contained in separate files and accessed during model execution. Output from the model is stored in binary files and used for post-processing. Post-processing techniques are presented in Section 5.6.

5.5 EMISSION SOURCE CHARACTERIZATION

A PSD increment emission inventory is developed for each applicable pollutant for input into AERMOD. Emission source data are collected to establish an emission inventory that details emissions and source parameters for the following:

- SO_2 and PM_{10} emissions and source parameters for major stationary sources that existed on the major source baseline date of January 6, 1975
- NO_2 emissions and source parameters for major stationary sources that existed on the major source baseline date of February 8, 1988
- Emissions and source parameters for SO_2, NO_2, and PM_{10} emissions from stationary, area, and mobile sources that existed on the minor source baseline date for the pollutant of concern in the HA being evaluated

Dispersion modeling is conducted using source inventories based on the above baseline dates to identify increment consuming and expanding sources. The source inventories are described in greater detail in Section 4.0 of this report.

The information developed to update the emission inventory or prepare a specific source application is used to update the ITS. When a refined emission inventory is developed, the information is used to update the information contained in the ITS. Any refined emission information must be developed using supporting documentation that addresses the emission calculations, and supporting assumptions.

5.5.1 Industrial Sources

Generally, industrial sources are modeled using AERMOD's point source algorithms. Emissions from industrial stacks are modeled as point sources using stack parameters obtained during data collection activities. In some cases, stack parameters for a particular stack differ between the baseline year and the current year. In these cases, the modeling should take into account the changes in stack parameters provided both sets of stack parameters were reliable to more accurately reflect the changes to the increment. Process fugitive emission units such as conveyor transfer points are also modeled as point sources. Typically, NDEP models process fugitive emission units as appropriately represented volume sources. However, due to the complexity of the modeling analysis and the additional detailed descriptive information that would need to be determined for these types of emission units, NDEP decided it was more prudent to represent these emission unit types as pseudo-stack sources. As such, these types of emission units are assigned low values for stack velocity and stack diameter, which tends to limit plume buoyancy providing a more conservative assessment of impacts from the emission source. Therefore, following guidance from NDEP, process fugitive emission units should be assigned a 10-meter stack height, ambient temperature, 0.01 meters per second exit velocity, and 1.0 meter stack diameter which represents an average equivalent diameter for these types of sources.

AERMOD currently uses the same direction-specific building downwash algorithms used by the ISC3 model. Because of the overall large number of sources in the modeling analysis, it was considered prohibitive to include building downwash for all sources, although it is NDEP's policy to include building downwash in dispersion modeling analyses. Building Downwash is therefore included for all major sources, and only those minor sources where complex terrain would be affected by the downwash calculations. Due to the potential relative importance of impacts from major sources, building downwash parameters are included for major sources in the modeling. Similarly, building downwash parameters are included for sources (major or minor) located in or near complex terrain, that are expected to be significantly affected by the downwash calculation. Building downwash parameters obtained for these sources during data collection activities are input to AERMOD to calculate building downwash effects.

5.5.2 Area Sources

Area source are comprised of mobile sources (both rail and on-road and off-road vehicles and miscellaneous sources as described in the following sections.

5.5.2.1 Mobile Sources

Countywide vehicle mobile source emissions for each of the years representing the minor source baseline dates of interest are input to the model. These emissions are used to evaluate the incremental difference in vehicle impacts since the applicable PSD baseline dates. Mobile source emissions are modeled as area sources and are apportioned into 1-km by 1-km grid cells across the respective HAs. This also includes the "fugitive dust" subcategory. The majority of the fugitive dust emissions result for paved and unpaved roads and are therefore attributed to the mobile source for distribution in accordance with VMT. This approach for distribution of the fugitive emissions has also been used by EPA in recent regional modeling. The mobile source emissions are apportioned into the separate appropriate grid cells as detailed in Section 4.0.

The estimated emissions of SO_2, PM_{10}, and NO_2 from vehicle mobile sources that are apportioned to each 1-km grid cell are added to the total area source emissions from that grid cell. The total area source emissions of each pollutant from that grid cell are modeled as area sources using AERMOD for separate predicted SO_2, PM_{10}, and NO_2 increment impacts.

Miscellaneous Sources

Emissions from the EPA NET database are modeled as area sources. The emissions were distributed on a county-by-county basis within the 1-km grid cells for use in AERMOD. As with the mobile source inventory, the established EPA SIP guidance was used as a technical reference. The techniques for apportioning area source emissions for the modeling are spelled out in greater detail in Section 4.0.

Each 1-km by 1-km area source used in the modeling was assigned an elevation equal to the average elevation within the grid cell. This approach has been used for area sources in similar studies (SW Colorado Increment consumption study), and is supported by EPA (EPA 2001). Because there are many area sources within each HA, and area sources require considerable processing time for the dispersion model, area sources are excluded from the modeling analysis only if they were determined to have an insignificant impact on air quality. For purposes of the ITS studies, an area source is estimated to have an insignificant impact if its emissions would contribute less more than 1% of the applicable PSD increment. A source's significance is estimated based on its total emissions and from test model runs. An area source with a total emission rate of approximately $6.5x10^{-9}$ grams per second per square meter was estimated to have an insignificant impact based on model test runs and grid squares with emissions of a pollutant less than this amount is therefore excluded from the modeling.

5.6 POST-PROCESSING

Model output files from AERMOD are combined in a post-processing step to determine PSD increment consumption. Pollutant impacts from baseline sources are subtracted from pollutant impacts from current sources on a receptor-by-receptor basis, with the difference resulting in PSD increment consumption. In some cases, the baseline impacts were greater than current impacts. This scenario resulted in PSD increment expansion at those receptors. As discussed in section 5.3, the ITS uses an unpaired analysis to evaluate increments consumption for periods less than annual unless meteorology is not available for the baseline period. If the same meteorological data set is being used for evaluation of both the baseline and current conditions a "paired" analysis is used. In addition, post processing is used when increment exceedances are calculated inside the fence line of a permitted facility. Since a facility does not consume increment within its own fenceline, when an exceedance is initially calculated within a fenceline, post processing will subtract out the contribution from sources attributed to that facility.

The post-processor is a FORTRAN executable program that was written, compiled, and linked in Lahey FORTRAN 90. The purpose of the program is to read several input data files, including files representing the baseline-year and current-year predicted impacts, and one file for the corresponding receptor set. These files are combined into predicted increment values at each receptor. GETINCSS combines the predicted baseline-year and current-year impacts into a predicted increment value at each receptor by subtracting the baseline-year impact from the current-year impact and writes these results to an output file. As described for the unpaired analysis, the maximum highest, second-high value for each receptor occurring during the baseline period will be subtracted from the maximum highest, second-high value calculated for the current sources. If the same meteorology is used for both the baseline analysis and the current source analysis, the post processing will be accomplished using an comparison of the value calculated at each receptor for each averaging period. The value calculated for the baseline will be subtracted from the value for he same averaging period calculated for the current source data..

The predicted impact files are unformatted output data from the AERMOD dispersion modeling for the averaging period of interest. Each unformatted file contain predicted concentrations for a single averaging period. GETINCSS is designed to work with input files that contain predicted impacts for one year of meteorological data at every receptor for a single averaging period. The increment averaging periods are 1 hour, 3-hour, 24 hour and annual. The unformatted files generated by AERMOD don't include information pertaining to receptor coordinates. Early versions of the ITS used a separate receptor file to identify which receptors that the impacts in the unformatted files represented. The separate receptor file used for identifying which receptor the unformatted file data represented in the post processing was the same file used in the AERMOD modeling. This required the ITS user to make certain the correct receptor and unformatted files were used in post-processing to allow the predicted impacts and receptor locations to be properly paired.

It has been determined that it will be a very simple step to add a few lines of code to the portion of the AERMOD FORTRAN code that writes unformatted files so that the receptor information is written directly to the top of the unformatted file. The resulting unformatted file from the revised AERMOD runs using the modified and recompiled code will include the receptor location information, thus eliminating the dangerous step of trying to pair the receptor files with matching unformatted files in post-processing.

GETINCSS uses a general input file with a predefined format called *getincss.inp,* and generates an output file called *incrment.dat*. The first line on the input file describes how many unformatted impact files will be used in the post processing. Each facility is modeled separately, so the post processing input files includes the number of facilities evaluated for each baseline and current analysis for each pollutant and averaging period. The next section of the input file lists the names of the files to be included in the post processing routine. A multiplier of -1.0 is applied to the baseline files, and a multiplier of 1.0 is applied to the current files. The baseline multiplier tells GETINCSS to subtract the baseline impacts from the total increment, and the current multiplier tells the program to add the current impacts to the total increment. The multipliers are listed after each file name. The last line of the input file tells the program how many meteorological days are being post processed. This feature was added so that post processing could be performed on impacts determined using leap year meteorological data files. To run GETINCSS and obtain increment results, complete the following:

- Create a folder in which the post processing can be accomplished
- Make sure this folder contains a copy of GETINCSS, the input file named *getincss.inp*, and the AERMOD receptor file used to model baseline and current impacts
- Copy or rename the AERMOD receptor file to *receptor.dat*
- Copy or move all the unformatted impact files being used in the post processing into the folder
- Make sure all the unformatted impact files to be incorporated into the post processing are both listed in the *getincss.inp* input file and present in the folder in which the post processing will take place
- Open a DOS prompt and go to the directory in which all the post processing files are located
- Type the name of the post processor, GETINCSS, and hit enter. The post processor will scroll through a string of data and the *increment.dat* increment file will be produced in the folder with the other files
- Rename the GETINCSS output file, *incrment.dat*, with identifying characters.

The following convention has been used to name the *incrment.dat* output file from GETINCSS:

AAPPMMIN.HH

Where:

AA = Two characters representing the HA, such as 76 for HA76, 83 for HA83, or 85 for HA85

PP = Two characters representing the pollutant modeled, such as SO for SO_2, PM for PM_{10}, and NO for NO_x

MM = Two characters representing the year of the meteorological data used, such as 00 for 2000.

IN = Two characters that read 'IN' which stands for increment results

HH = Two characters representing the averaging period of the modeling, such as 24 for 24-hour, 03 for 3-hour and AN for annual

6.0 CONCLUSIONS

As outlined in the Clean Air Act, the State of Nevada is responsible for assuring that PSD increments are not exceeded. To accomplish this, NDEP developed the ITS to track PSD increments on a pollutant-by-pollutant basis for each HA where the PSD has been triggered. The ITS stores, maintains, and provides information regarding PSD increment consumption and expansion in triggered HAs in Nevada.

A Source Impact Analysis as defined in 40 CFR 51.166(k) is required for sources affected by the PSD regulations. PSD increment impacts are net changes in impacts, between baseline and current conditions. The State of Nevada has developed the ITS specifically to provide a tool to track baseline and current existing source inventories and provide baseline and current impact assessments. The baseline and current impacts are used to calculate net changes in ambient impacts that result from changes at existing sources, between baseline dates and current conditions, resulting in PSD increment changes. Changes to the PSD increment are caused by net changes in air quality impacts in a triggered HA, compared to baseline conditions. This effect of applicable changes to PSD increments is determined by calculating net air quality impacts through the use of air quality dispersion models. The ITS allows the calculation of increment consumption using an "unpaired" analysis. This is a departure from the EPA recommended procedures for increment analysis performed as part of New Source review, but is valid for wide area analysis. In specific cases where the same meteorological data is used to assess increment impact a "paired" analysis can be used.

PSD increment net changes are tracked relative to baseline conditions on two key baseline dates of the pollutant of concern, one for minor sources and one for major sources of the pollutant of concern. Minor source baseline dates are established following major source permitting actions in each HA, while major source baseline dates were established in 40 CFR 51.166(b)(14)(i). After the minor source baseline date is triggered in a HA, PSD increment is affected by:

- Changes at minor stationary sources and changes to area or mobile sources within the triggered HA following the minor source baseline date for a particular pollutant for that HA
- Modifications to major sources within or outside the HA following the major source baseline date for a particular pollutant

The computer-based system for the tracking of PSD increments in Nevada will allow the NDEP to maintain PSD increment source inventories and track available PSD increment. It is the intent of the NDEP to use the ITS to track the increment in each of the HAs throughout Nevada. The information available through the ITS will provide NDEP, as well as local planners, developers, and industry, with the information necessary to assure compliance with the PSD increments.

The ITS provides:

- Ready access to major and minor source baseline and current permitted emissions data
- Dispersion modeling input files for PSD increment affecting sources
- Tools to enhance the review of PSD impact modeling analyses

In addition, the ITS provides the tools to allow the expedited completion of the following tasks:

- Entering source data
- Querying source data
- Generating model input files
- Reviewing modeling results
- Generating emissions and modeling reports

Source information used in determining PSD increment impacts was obtained from the best resources available. Stationary point sources data are developed from numerous resources including:

- NDEP permit, source, and emissions database
- State and county air quality agency historical files
- Nevada Minerals Industry Listings
- Permit applications from applicable sources
- State Mines Inspection Reports for the minor and major source baseline dates

Area source information was obtained from the AIRs Data and the NET for the current date and minor source baseline dates.

Future refinements of this system are anticipated in the following areas:

- Baseline and current source data
- Fugitive Emissions
- Volume Sources

- Building effects
- Dispersion modeling

The baseline and current source data are based on the best available data. Although the baseline emissions are not likely to be updated, the current source data for area sources may be able to be refined. The current source information was based on projections and estimates contained in the NET data. It is possible that future efforts may identify better area source emission data and this information can be used to update the source inventory data. NDEP will be working to improve the database of area source information based on improving guidelines. There is flexibility built into the emission estimates to accommodate local conditions such as silt content, and moisture. To date, limited local information has been contributed to the area source estimates. However, it is anticipated that in the future, site specific emission estimates will be provided for some of the area source categories. This information will help refine the source data in the ITS. In addition to area sources, future refinements could be made to the major and minor source information to update and refine the source data.

The estimate of fugitive emissions in Nevada needs to be refined. EPA emission factors for area sources of fugitive dust (including paved and unpaved roads and other fugitive dust sources) have been identified as a very conservative estimate. EPA has decided to reduce this number by a factor of 4 based on recent modeling efforts and the assumed transportability of the dust generated from ground level sources. In addition, or in contrast to this, there are sources of fugitive dust within the fenceline of some stationary sources that are currently not included in the inventory. For example, fugitive dust emissions resulting from off road vehicles (haul trucks, front loaders, graders, etc.) are not included in the EPA emissions estimates for area sources. In Nevada, fugitive dust emissions from these sources are not included in stationary source emissions. To develop a true estimate of fugitive dust emissions, these sources of fugitive dust at stationary sources must be included.

As described earlier, NDEP usually models process fugitive emissions as “volume” sources. However, due to the complexity of the modeling analysis for this project and the additional detailed descriptive information that would need to be determined for a volume source, a decision was made t use conservative point source parameters. A future refinement could include a re-inspection of these sources to establish appropriate volume source parameters.

Even though the model calculates building downwash effects, not all building parameters with a potential to cause downwash were included. The building dimensions were included for major sources and selected minor sources. The minor sources were selected where the potential existed for complex terrain, or the building downwash affects would be critical. Future refinements to the ITS could include additional building dimensions for stationary sources.

Historically, refinements are made to the dispersion model as hardware and software technology evolves. As developed, the ITS provides input to a dispersion model regarding sources affecting the PSD increments and provides a tool to review the model output graphically/visually. The separateness of the dispersion model allows refinements to the dispersion modeling (whether this is the model itself, or model inputs, including meteorology) to be incorporated, and essentially refine the increment assessment.

7.0 REFERENCES

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